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The AUTOMOBILE

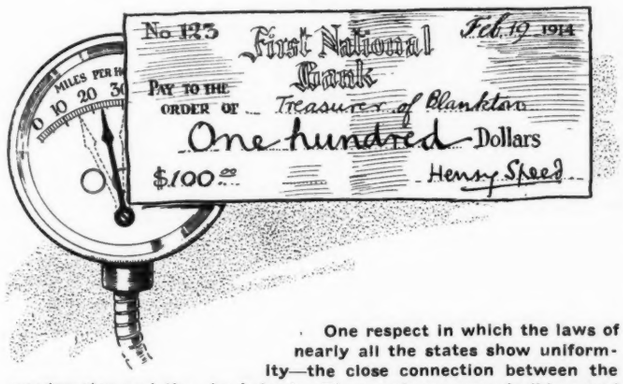
Present Automobile Laws Show Lack of Uniformity

While Some Are Drawn Up in an Intelligent and Reasonable Form, Others Embody the Mistaken Ideas of Legislators Unfamiliar with Conditions

A Review of the Measures Now in Force

GREAT progress has been made in automobile legislation in the past year although there is still a great deal to be desired along this line. Last year there were nine states without any sort of an automobile law, while this year there is only one, our most backward state in this respect being Louisiana. Those that have adopted new laws in the past few months are: Arizona; Colorado; Kansas; Louisiana; Montana; New Mexico; Oklahoma and Wyoming. In addition, twenty-five states have revised and improved their existing statutes.

Lack of uniformity is still the crying objection to the laws now in force although the tendency during the past year has been toward unifying the provisions in the different states. The changes that have been made by the twenty-five states mentioned and the laws adopted by the newcomers have resulted in much greater uniformity.



One respect in which the laws of nearly all the states show uniformity—the close connection between the speedometer and the check-book. The maximum permissible speed varies from 15 to 30 miles per hour. Above these speeds, for a first offense, the fines run up to $100 and, in some states, even more

Much progress is still to be made, however, not only as regards uniformity but in various other ways. Many of the laws have been poorly thought out, not enough time has been spent on them in some cases and in others it is quite evident that the legislators who had the task in charge were not sufficiently conversant with the work in hand to frame up a satisfactory bill. Other measures possess the fault of being inadequate, and show that they were drawn without any clear idea of what the requirements of an automobile law are or what it should accomplish. Logically thought-out measures are scarce although some of the states have statutes which show care in preparation. From this it would seem that some states have put through legislation concerning the automobile just because they felt that they must follow the lead of other, and, in most cases, more progressive states. In fact the main difficulty with the laws of the present day relating to automobiles is that these laws have not been thought out on a logical basis with the requirements of such legislation clearly in mind both as regards the regulation of motor vehicles and operators belonging to that state and of non-residents. The best indication that the laws in the different states have not been constructed on a logical, rational plan is the fact that they are not more uniform. The conditions relating to automobiles are much the same throughout the country and therefore the variance of the measures in vogue in the different states must be due in a large measure to this fact.

In making a study of the different laws there is one simple point on which all the states agree, and that is the requiring of the registration of cars, but beyond this point there is little concordance. The registration of chauffeurs and the granting of special licenses to dealers is becoming general. Only nine states have no provision for dealers while chauffeurs have to take out licenses in thirty, but in only nineteen of these are badges required. The average dealer's fee is $25 entitling the dealer to use several sets of plates.

The maximum is that exacted in Alabama where $100 is required. In most states the cost of a chauffeur's license is very reasonable, being about $2, although in a few $5 is exacted, but even this amount can hardly be considered a burden. Often the renewal fee is less than the initial one; for instance in New York state a chauffeur registering for the first time must pay $5, and from the end of that calendar year the charge is $1 per annum. Examination of chauffeurs before licenses are granted is the exception rather than the rule. In a few instances, any man who operates a car must have a license, whether he be an owner, chauffeur or a friend of one or the other, but this provision is made only by the minority.

Minimum Age in Thirty States

A minimum age for operators is specified in thirty states, the average age being 16 and the lowest is registered by Kansas which sets the limit at 14. In most cases where the age limit for operators is less than 18 a special provision is made requiring a chauffeur to be at least 18.

Thanks to the agitation carried on by the various automobile magazines and clubs throughout the country in the past, most of the states now offer more or less limited privileges to residents of other states. It is now possible to tour in almost any part of the country without being worried by having to obtain a new set of tags every time a new state is entered. Only three states, South Carolina, Tennessee and Texas, do not allow some form of exemption to tourists. In the latter state this can hardly be called an objection because the registration fee is only 50 cents. In most states reciprocal privileges are allowed, that is, the state gives the tourist the same treatment that his own state grants to tourists. In some instances, the tourist is only allowed a week or 10 days but, on the whole, the provisions are so broad that in touring one can almost forget that there may be a registration law to be complied with.

Speeds Laws Becoming Reasonable

The speed allowed is another point that is receiving more sane consideration in the formulation of the new laws. Most states have approached this subject in a sensible way and so the freak laws of a few years ago are not in evidence. It is becoming generally understood that a fairly high rate of speed can be maintained in the country without danger and so it is found that a number of the states specify 30 miles as the limit, while the average of all the states is close to 25. A few impose a restriction of 20 or less and one, South Carolina, forbids traveling faster than 15 miles per hour, even in the sparsely settled tracts. Some states even go so far as to place no specific limit on the speed. But in almost every case, no matter at what figure the speed limit is put, there is a proviso stating that at all times machines must not travel faster than is reasonable and proper. Every state

State	Register With	To Be Registered	Registration Fee	Certificates and Tags	Driver's Fee and Badge
Alabama	Secretary of State	Car and owner	$7.50 to $25	One tag	$5; Badge
Arizona	Secretary of State	Car, owner and chauffeur	$5 to $10	Certificate and two tags	$5
Arkansas	Chairman State Highway Com.	Car, owner and chauffeur	$10	Certificate, seal and one tag	$1; Badge
California	Secretary of State	Car, owner and chauffeur	$2 to $30	Certificate and two tags	$2; Badge
Colorado	Secretary of State	Car, owner and chauffeur	$2.50 to $10	Certificate and one tag	$1; Badge
Connecticut	Secretary of State	Car and operator	$.50 per h.p.	Two tags	$2; Plate
Delaware	Secretary of State	Car and owner	$5	Certificate and tags	$5
District of Col.	Commissioner	Car and owner	$5	Certificate and tags	$2
Florida	Secretary of State	Car owner and operator	$2	Certificate and one tag	$2
Georgia	Secretary of State	Car and owner	$2	Seal and two tags	No provision
Idaho	Highway Com.	Car and owner	$15 to $40	Certificate and tag	No provision
Illinois	Secretary of State	Car, owner and chauffeur	$4 to $10	Certificate, seal and two tags	$5; Badge
Indiana	Secretary of State	Car, owner and chauffeur	$5 to $20	Certificate and two tags	$2; Badge
Iowa	Secretary of State	Car and owner	$15	Certificate and tags	No provision
Kansas	Secretary of State	Car and owner	$5	Certificate and tags	No provision
Kentucky	Secretary of State	Car and owner	$5 to $20	Seal and two tags	No provision
Maine	Secretary of State	Car, owner and operator	$5 to $15	Certificate and two tags	$2
Maryland	Commissioner Motor Vehicles	Car and owner	$5 to $25	Certificate and two tags	Operator, $2. Chauffeur, $5
Massachusetts	State Highway Commissioner	Car, owner and operator	$5 to $25	Certificate and two tags	$2
Michigan	Secretary of State	Car, owner and chauffeur	$.50 per h.p.	Certificate and two tags	$2; Badge
Minnesota	Secretary of State	Car, owner and chauffeur	$1.50	Two tags	$2; Badge
Missouri	Secretary of State	Car, owner and chauffeur	$3 to $12	Certificate and one tag	$1.50; Badge
Montana	Secretary of State	Car and owner	$2	Certificate and tags	$2; Badge
Nebraska	Secretary of State	Car and owner	$2	Certificate and tags	No provision
Nevada	Secretary of State	Car and owner	$.12 1-2 per h.p. Minimum, $2.50.	Seal and one tag	No provision
NewHampshire	Secretary of State	Car, owner and chauffeur	$10 to $40	Certificate and two tags	$5; Badge
New Jersey	Assistant Secretary of State	Car, owner and operator	$4.50 to $15	Certificate and two tags	$2 to $4; Certificate
New Mexico	Secretary of State	Car and owner	$2 to $12	Certificate and tag	No provision
New York	Secretary of State	Car, owner and chauffeur	$5 to $25	Certificate and two tags	$5; Badge
No. Carolina	Secretary of State	Car and owner	$5 to $10	Certificate and tag	No provision
No. Dakota	Secretary of State	Car and owner	$3	Certificate and tags	No provision
Oklahoma	Highway Comm.	Car and owner	$1	Certificate	No driver's fee
Oregon	Secretary of State	Car, owner and chauffeur	$3 to $10	Two tags	$2; Badge
Pennsylvania	Highway Department	Car, owner and chauffeur	$5 to $15	Certificate and two tags	$2; Badge
Rhode Island	State Board Public Roads	Car, owner and operator	$5 to $25	Certificate and two tags	$1
So. Carolina	County Clerk	Car and owner	$1	One tag	No provision
So. Dakota	County Clerk	Car and owner	$3 or $6	No tags	No provision
Tennessee	Secretary of State	Car and owner	$3	Certificate and tag	No provision
Texas	County Clerk	Car and owner	$.50	Certificate and tag	No provision
Utah	Secretary of State	Car, owner and chauffeur	$2	Seal and one tag	$2; Badge
Vermont	Secretary of State	Car, owner and operator	$1 per h.p.	Certificate and two tags	$2; Badge
Virginia	Secretary of State	Car, owner, operator & chauffeur	$5 to $20	Certificate and one tag	$2.50; Badge
Washington	Secretary of State	Car and owner	$2	Certificate and tag	No provision
West Virginia	State Auditor	Car, owner and chauffeur	No fee; car is taxed.	Two tags	$2; Badge
Wisconsin	Secretary of State	Car and owner	$5	Certificate and tags	Local provision
Wyoming	Secretary of State	Car and owner	$4	Certificate and tags	No provision

Louisiana is the only state which to date has had no state law. In Mississippi and Ohio the state law has been declared invalid and no new laws have yet been enacted.

Age of Driver	Dealers' Fees	Exemption of Non-Residents	License Year	Speed Limit in Country, m.p.h.	Fine for Speeding	Lights
16	$100; Extras $1	Reciprocal	Oct. 1 to Sept. 30	30	$25	Standard*
No provision	Reg. one car; duplicates $.50	Exempt	Jan. 1 to Dec. 31	30		Standard*
18	$10	Exempt	Jan. 1 to Dec. 31	20	Not over $200	Two white front†
No provision	$50 for 5; $10 in excess of 5	Exempt	Year from date of issue	30	Not over $100	Standard*
No provision	$5	90 days per yr.	Jan. 1 to Dec. 31	No provision	$25 to $250	Standard*
18	$50	Reciprocal	Jan. 1; Dec. 31	25	Not over $500	Standard*
16	$5 per car	License; No fee.	Jan. 1; Dec. 31	20	$10 to $200	Standard*
18	$2	Reciprocal	Perennial	20	No provision	Front and rear.
No provision	No provision	30 days per yr.	Perennial	Reasonable and proper	Not over $260	Two white front
16	No provision	30 days per yr.	Perennial	Reasonable	Varies	Front and rear.
No provision	$35; duplicates $1.	Reciprocal	Jan. 1; Dec. 31	30	Not over $300	Standard*
18	$5; duplicates $1.	60 days per yr.	Jan. 1 to Dec. 31	25	$200	Standard*
18	$25; duplicates $1.	Reciprocal	Jan. 1 to Dec. 31	25	$100	Standard†
No provision	$15; duplicates $1.	Reciprocal	Jan. 1; Dec. 31	25	Not over $100	Standard*
14	$5	30 days per yr.	July 1; June 30	25	Not over $100	Front and rear.
No provision	Register 1 car	Exempt	Year from issue	20	Varies	Standard*
16	$25 for 5; duplicates $.75	30 days	Jan. 1 to Dec. 31	25	Not over $50	Standard*
Operator 16 Chauffeur 18	$24 for 4; duplicates $6	2 non-consecutive wks. per yr	Jan. 1 to Dec. 31	25	Not over $200	One white front One red rear
16	$25 for 5; duplicates $5	10 days per yr.	Jan. 1 to Dec. 31	20	Not over $100	Standard*
18	$50 for 5; duplicates $5	Reciprocal to 90 days	Jan. 1 to Dec. 31	25		Standard*
Operator 16 Chauffeur 18	$10; duplicates $1.	30 days per yr.	Jan. 1 every 3d yr. to Dec. 31	25	Varies	Standard*
18	$10; duplicates $5.	30 days per yr.	Feb. 1 to Jan. 31	25	Not over $100	Standard†
No provision	$10 for each type.	Exempt	Perennial	Reasonable	$50 and $100	Standard*
16	1 of each type	30 days per yr.	Jan. 1; Dec. 31	25	Not over $100	Front and rear.
No provision	Reg. 1 of ea. type; duplicates $1.	30 days per yr.	Jan. 1 to Dec. 31	Reasonable and proper	Not over $100	Standard*
Operator 16 Chauffeur 18	$25 for 6	10 days per yr.	Jan. 1 to Dec. 31	25	Not over $100	Standard*
16	Not over 5 sets; $5 per set	Reciprocal	Jan. 1 to Dec. 31	25	Not over $100	Standard*
14	$12	60 days per yr.	Jan. 1; Dec. 31	No provision	No provision	Standard*
18	$15 for 1; duplicates $1	Reciprocal	Jan. 1 to Dec. 31	30	Not over $50	Standard*
16	$10; Extras $1	Reciprocal	July 1; June 30	25	Not over $50	Standard*
No provision	No provision	Exempt	Jan. 1; Dec. 31	30	Not over $50	Standard*
No provision	No dealer's fee	Not exempt	Jan. 1; Dec. 31	No speed limit	No provision	No provision
18	$10; duplicates $2.50	30 days per yr.	Jan. 1 to Dec. 31	25	Not over $50	Standard*
18	$5	10 days per yr.	Jan. 1 to Dec. 31	25	$10 to $25	Standard†
16	$50	20 days per yr.	Year from date of issue	25	Not over $500	One white front One red rear
No provision	No provision	Not exempt	Perennial	15	$10 to $100	Front and rear.
15	$10; duplicates $1.	Reciprocal	Jan. 1; Dec. 31	25	Not over $100	Standard*
No provision	No provision	Not exempt	Perennial	20	$25 to $100	No provision
No provision	No provision	Not exempt	Perennial	18	$5 to $100	One lamp
No provision	$2 for each type; duplicates $.50	Exempt	Perennial	20	Varies	Standard*
No provision	$25	Reciprocal	Year from date of issue	25	Not over $50	Standard*
No provision	$50	2 non-consecutive wks. per yr.	Jan. 1 to Dec. 31	26	Not less than $10	Standard*
No provision	No provision	Exempt	June 1; May 31	24	$100	Front and Rear
No provision	No provision	Reciprocal	Perennial	20	Not over $100	Standard*
16	$10 for 8	Exempt	Jan. 1; Dec. 31	25	Not over $100	Front and rear
15	No provision	Exempt	Jan. 1; Dec. 31	Reasonable	Not over $100	Front and rear

*Two adequate white lamps in front and one rear lamp showing a red light.
†Same as above, except that license numbers must be shown in the lamps.

has special regulations, for the more thickly settled portions. Generally one limit is set for suburban districts and another for the cities.

The fixing of heavy penalties for running away after an accident and for a driver operating a machine in an intoxicated condition is becoming more general, about thirty states having statutes making the former a serious offense and twenty-five states doing the same with regard to the latter.

Ten states require the registration of all self-propelled vehicles while the rest exclude certain classes of machines. Traction engines and road rollers are generally exempted, thirty-four states making no provision for them. It is also common to allow fire engines, police patrols, and ambulances to go without license tags and a number of states in addition place municipal vehicles of all sorts in this category, this list including, sprinklers and the like.

It is also interesting to note in this connection that two states, Iowa and South Dakota, do not require the registration of commercial vehicles.

Three Lights Standard

Uniformity in the matter of lights, horns and brakes is noticeable, most states requiring two lights in front and one in the rear, and also specifying that a horn and adequate brakes be fitted. Some require only one light in front and others, in addition to having a rear lamp showing red, stipulate that it must illuminate the rear number with a white light, but no state requires that more than three lights be used.

Some rather unusual provisions are noted. For instance, anti-skid devices are prohibited under certain conditions by nine states although these allow the use of such devices when safety requires. Mufflers are required by ten states, while two specify that the exhaust shall be turned upward and two others have laws against smoking.

Four States Limit Weight

Besides these, there are several special limitations that are interesting. New Jersey, Vermont, Washington and Massachusetts limit the total weight and the load per inch of width of tire. New Jersey's law is a fair example of these, the maximum allowable weight being 25,000 pounds and the allowable load per inch of tire width being 800 pounds.

Pennsylvania is the only state that sets a maximum on the width of the vehicle, but in this state 100 inches must not be exceeded.

Many other facts of interest can be obtained from the accompanying table which gives the main points of the laws of all the states. After studying this table it must be concluded that the present difficulty with automobile legislation is a general lack of uniformity between the various laws, largely due to the insufficient care and skill expended in their formation.

Exhaust Gas Analysis for Economy

What Carburetion Is—Part III

By Herbert Chase

¶ *Continuation of report on tests conducted by* The Automobile *and a complete table of the results of the analyses of the exhaust gas samples which show widely varying degrees of efficiency of carburetion and combustion in the cars tested. Average ton-mileage obtained in the case of trucks greatly exceeds that of passenger cars. Correctness of mixture determined by figures.*

ONE of the most important uses which an exhaust gas analysis serves is evidenced by the curves, Fig. 2, shown at the lectures of Prof. Watson at the Royal Society of Arts. London, Eng., in 1910. These were plotted from the results of a large number of analyses and show how the products of combustion varied with the different ratios of air to gasoline.

Prof. Watson states that *it is possible, by making an analysis of a sample of gas taken when the motor is running under a certain set of conditions, to determine by the use of the curves, the relative proportion of gasoline and air which the carbureter furnished under that set of conditions and from these results to reset the carbureter in such a way as to get, within reasonable limits, the proper strength of mixture.* This is doubtless true when the combustion is complete or as nearly complete as the quantity of oxygen present will admit of it being. It does not appear to hold, however, when, in spite of the fact that sufficient oxygen is present, combustion is not completed.

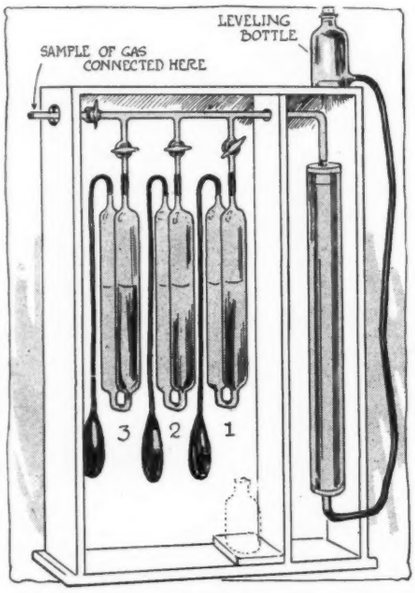


Fig. 1—Orsat exhaust gas testing apparatus. The gas is passed consecutively into the three pipettes at the left and volumetric measurements of the constituents made in the burette at the right

Prof. Watson states further that oxygen and CO are never found together, except in the smallest quantities, in the exhaust from the four-cycle motor, but with this statement several other investigators, including the writer, are not in accord. The tests made as a part of the present investigation by The Automobile, show otherwise as do also others which the writer has made. And there seems to be a very logical explanation for this condition—namely that *all the molecules of CO do not come into contact with the molecules of oxygen within the limited time during which the temperature and other conditions are such that combustion will take place.*

Four Rules to Follow

It appears reasonably certain that the following rules can be followed without error:

I. If the exhaust contains both CO and O_2 in considerable quantities (say more than 1 per cent. of each) the presumption is that the gasoline and air were not well mixed, either because of inadequate spraying, condensation, or insufficient heat for vaporization.

II. If CO appears in the exhaust without more than a trace of O_2 being present, the mixture is too rich and the supply of gas should be cut down.

III. If the exhaust contains only a trace of either or both O_2 and CO the balance being CO_2, the combustion is complete or substantially so. Probably a slight increase in the air will decrease the gasoline per horsepower hour.

IV. If the exhaust is free from CO and contains more than 4 per cent. of O_2, the mixture is too lean and more gas should be admitted. It should be noted that the curves, Fig. 1, indicate that when the exhaust contains 4 per cent. of O_2, 11 per cent. of CO_2, and no CO the ratio of air to gas is 17 to 1,—*the ratio which Professor Watson found in his experiment gave the maximum thermal efficiency.*

In general the nitrogen which enters the motor as a part of its charge of air constitutes about 85 in each 100 volumes of exhaust gas. Since it does not enter into the chemical reactions which take place within the engine cylinder, its presence can be neglected in so far as the purposes of this article are concerned. Hydrogen and methane are seldom found in the exhaust from a four-cycle motor and when present the quantity is so very small that their presence may safely be considered negligible. A quite different set of conditions enters in the case of two-cycle motors, consequently the rules laid down and the discussion preceding them must be taken as applying chiefly, and in some cases exclusively to the four-cycle type to which all the motors here tested belong.

CO Is Very Poisonous

Beside the inefficiency resulting from incomplete combustion, there are other disadvantages in having carbon monoxide in the exhaust gas. One serious consequence which may result under certain conditions is the possible poisoning of persons who inhale the gas for a considerable length of time. CO is very poisonous when not diluted with other gases and the effect is only less in degree when it forms but a comparatively small proportion of the gas inhaled. The evidence of poisoning may be nothing worse than a hard headache, but persons who work every day in ill-ventilated garages, the atmosphere of which is seldom free from the gas exhausted from motors, may easily suffer more serious consequences.

Imperfect combustion is also the cause of a foul smelling and often of a smoky exhaust. It is a well known fact that an over-rich mixture causes black smoke from this cause.

Overheating the Exhaust

In cases where the exhaust leaving the motor contains both oxygen and CO as a result of poor mixing, the combustion may continue in the exhaust pipe and cause the latter to become excessively hot. This overheating often results in scorching the paint on parts adjacent to the exhaust pipe and may under cer-

tain conditions cause a serious fire. All of which are arguments in favor of securing the most complete combustion possible.

Analyzing the Gas

The table, pages 444 and 445, contains particulars of the cars, all the data obtained during the road test, as well as the results of the analyses of the gas samples taken.

The gas was analyzed in a three-pipette Orsat apparatus, Fig. 1, the exact quantities of CO_2, O, and CO being determined by bringing the gas consecutively into contact with the three absorbents in the pipettes 1, 2 and 3. In the first of these is a solution of caustic potash, KOH; in the second is alkaline pyrogallate, while the third contains a solution of cuprous chloride. Rubber bulbs are provided in connection with the pipettes and may be used to agitate the solution within and so facilitate absorption.

On passing into the first pipette *the CO_2 in the sample of gas will combine with the KOH.* The remaining gas is then measured in the burette and passed into the second pipette. *The alkaline pyrogallate here absorbs all free oxygen present in the gas.* Another volumetric measurement is then made. The decrease from the previous reading will show the percentage of O_2 absorbed. Thus if the first reading was 9.5 per cent. of CO_2 and the second 11.2 the difference, 1.7 per cent. is free oxygen.

The CO is now removed by admitting the remaining gas to the third pipette where the carbon monoxide combines with the cuprous chloride. The decrease in volume is again measured in the burette thus determining the percentage of CO present in the sample.

The remaining gas consists of nitrogen with a possible admixture of hydrogen and some light hydrocarbon such as methane. The two latter are seldom found in the exhaust from a four-cycle motor and when they appear the percentage is small. Consequently we need not give them serious consideration in this very general treatment of the subject. For the most part the material in the tables is self explanatory, but will yield some food for thought to those who are interested in the production or operation of efficient automobiles.

Story of the Tabulation

Each of the fifteen vertical columns contains the data of one car designated on the first line by number, the first twelve columns being devoted to the passenger cars and the three remaining to trucks. The upper half of the table gives the particulars of the various cars tested. The lower half is divided into three horizontal sections, the first giving the gasoline record; the second the exhaust gas analysis; and the third, the conditions obtaining when the respective samples were taken.

The letters A to I at the left of the gasoline table refer to those portions of the route followed bearing these letters on the profiles Fig. 3. They enable the reader to see at a glance the profile of the route over which the passenger cars traveled while using the quantity of gasoline indicated in the first of the five vertical divisions devoted to each car. The lines marked J and K denote runs of 2 miles each made largely in traffic similar to that on Fifth avenue where frequent stops are necessary, the exact course followed not being designated on the map but being the same for all the pleasure cars.

The letters L to Q at the right of the same table indicate the profile of the course the trucks covered while using the quantity of gasoline indicated in the adjoining columns.

At the left of the section devoted to the record of exhaust gas analyses is noted the condition under which the respective samples of gas from the passenger car motors were collected, while at the right is a similar notation for the samples from the truck motors. (The analyses were noted in the order taken and bear a similar number 1 to 9, given in the left-hand column of last two sections).

In order to make the results clear to those not used to such data as is contained in the table it will perhaps be useful to analyze these figures and point out in the light of the foregoing discussion the reasons for the conditions existing and the remedy when the condition may be improved by means familiar to those who have studied the subject. Separate reports on the results of each car, as tabulated on pages 444 and 445, follow:

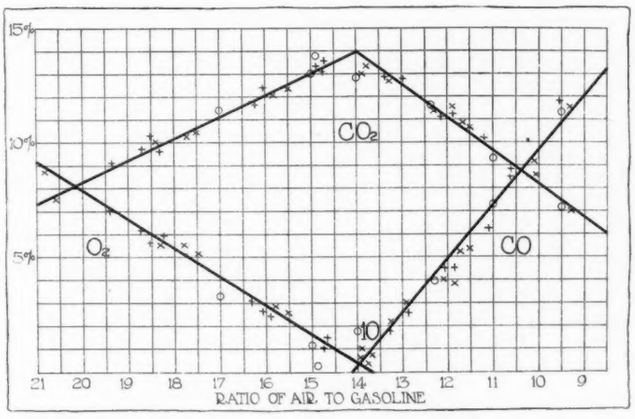


Fig. 2—Curves plotted from tests by Professor Watson which show the relation between the products of combustion and the ratios of air to gasoline

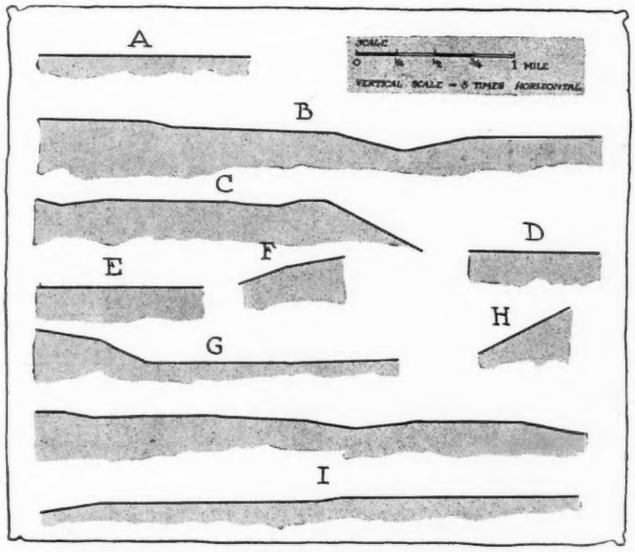


Fig. 3—Profiles of the sections of the route over which the tests were made. The reference letters correspond to those appearing on the table, pages 444 and 445, opposite the results obtained on the sections indicated

Performance of No. 1

First let us consider Car No. 1 which has a four-cylinder motor of 3 3-4-inch bore and 5 1-8-inch stroke fitted with the manufacturer's own design of carbureter. The inlet manifold of this motor is cast inside the waterjacket of the motor so that it is kept warm at all times and condensation should not occur. The gas analysis would, therefore, be expected to show but little CO providing the proportion of air to gas is correct, and the mixing thorough.

The column headed O_2 shows that only a trace of oxygen was found at any time. The mixture was therefore, never very lean. In only one case was there less than 11 per cent. of CO_2 which of itself indicates pretty good combustion since with this percentage of CO_2 present there can be but little CO. In fact it is seen that the average percentage of CO is a little less than 1.4.

With these proportions of CO_2, O_2, and CO we find by reference to Professor Watson's curves, Fig. 1, that the average ratio of air to gasoline was in the neighborhood of 13 to 1, a little under the theoretical quantity necessary for perfect combustion.

The obvious conclusion is that a little more air would have produced better combustion. However, a little might

Complete Results of Exhaust Gas Analy

SPECIFICATIONS OF CARS — PASSENGER CARS

Number of Car	1	2	3	4	5	6	7
Weather	Cloudy	Clear	Clear	Clear	Cloudy—Showers	Clear	Clear
Temperature	77 Degrees	80 degrees	85 degrees	65 degrees	65 degrees	75 degrees	82 degrees
Barometer	29.7	29.6	29.76	30.06	30.15	30.15	......
Humidity	70 per cent.	54 per cent.	57 per cent	54 per cent.	56 per cent.	80 per cent.	75 per cent.
Weight on test	1.87 tons	2.7 tons	22.65	2 34	2.22	2.42	2.55
Tires (rear)	34x4	37x5	36+4½	36 13-16x5 5-16	36x4½	37x5	36x5
Tires (front)	34x4	37x5	36+4	36 13-16x5 5-16	36x4½	36x4½	36x4
Inflation, rear	70 lbs.	80	85	85	85	85	90
Inflation, front	70	80	80	85	85	80	80
Gear ratios, first	13.88	13.88	10.9	12	10	12.65	8.93
Gear ratios, second	6.4	6.42	5.5	6.5	5.38	7.1	5.32
Gear ratios, third	4 direct	4 direct	3.7	5	3 (direct)	5.44	3.62
Gear ratios, fourth	2.96	2.96	2.7 (direct)	3.25 (direct)	......	3.3 (direct)	2.59 (direct)
No. of jets, carbureter	One	Two	2	6	1	1	2
Air intake, (hot—cold)	Cold	Cold	Cold	Cold	Cold	Hot	Cold
Water jacket	(Not used)	(Not used)	No	No	No	Yes	Yes
Motor bore—stroke	3¾x5¼	4¼x5¼	5¼x5¼	3.54x5.51	4¼x6	4¼x4¾	4¼x5½
Number of cylinders	4	6	4	8	4	6	6
Valve position	One side	One side	One side	One side	Both sides	Both sides	Both sides
Spark plug position	Over intake	Over intake	Over intake	Over inlet	Over inlet; over exhaust	Over inlet; over exhaust	Over inlet
Plugs per cylinder	One	One	One	One	Two	Two	One
Oiling system	Splash	Splash	Pump	Pressure	Splash	Pump	Splash and Pump
Water circ., pump	Gear	Gear	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal
Ther. syphon	......	......	......	......	......	......	......
Ignition	H. T.	H. T.	H.T. dual	H. T.	H. T.	H. T.	H. T. Dual
Magneto	Mea	Mea	Bosch	Bosch	Bosch	Bosch	Bosch

A Record of the Gasoline Consumption, Miles Per Gallon, Ton-Miles

Test No.	Test No.	Miles, Trucks	Miles, Passenger Cars	Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Transmission Gear No.	Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Trans. Gear No.	Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Trans. Gear No.	Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Trans. Gear No.	Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Trans. Gear No.	Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Trans. Gear No.	Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Trans. Gear No.
A	L	3.5	1.33	.016	22.2	41.5	10	2	.2	6.6	17.8	10	3	.24	5.5	12.5	15	3	.20	6.6	15.4	15	3	.16	8.3	18.4	15	3	.25	5.3	12.8	15	3	.165	5.0	12.8	15	3
B	M	1.17	3.75	.216	17.3	32.3	15	3	.345	10.9	29.4	15	3	.798	4.7	10.6	15	3	.40	9.3	21.5	15	3	.32	11.7	16.0	15	3	.56	5.2	12.6	15	3	.32	11.7	29.8	15–20	4
C	N	1.73	2.38	.14	17.0	31.8	15	4	.225	10.6	28.6	12	3	.28	8.5	19.2	20–15	2–3	.28	8.5	19.9	15–20	3	.14	17.0	37.7	15–20	3–2	.32	7.4	17.9	20–15	2–3	.21	11.3	28.8	15–20	4–2
D	O	2.0	0.75	....	....	....	....	....	.14	5.4	14.6	25–30	3	.17	4.4	10	20–30	3	.125	6.0	14.0	20–30	3	.145	5.2	11.5	20–30	3	.125	6.0	14.5	20–30	3	.10	7.5	19.1	20–30	4
E	P	0.4	1.0	....	....	....	....	....	.085	11.8	31.8	15	3	.125	8.0	18.1	15	3	.13	7.7	18.0	15	3	.095	10.5	23.3	15	3	.16	6.2	15.0	15	3	.15	6.7	17.1	20	4
F	Q	3.87	0.64	....	....	....	....	....	.11	5.8	15.7	20	4	.12	5.3	12.0	20	3	.13	4.9	11.5	20	4–3	.11	5.8	12.9	20	3	.15	4.3	10.4	20	4	.13	4.9	12.5	20	4
G			2.4	.16	15.	18.1	15	4	.19	12.6	34	20	4	.27	8.9	20.2	20	4	.25	9.6	22.5	20	4	.225	10.7	23.7	20	3	.28	8.6	20.8	20	4	.28	8.6	21.9	20	4
H			0.47	.09	5.2	9.7	14	2	.18	2.6	7.0	20	2	.16	2.9	6.5	20	2	.12	3.9	9.1	20	2	.10	4.7	10.4	20	2	.15	3.1	7.5	20	2	.155	3.0	7.6	20	2
I			7.08	.335	21.1	39.4	20	4	.58	12.2	32.9	20	4	.73	9.7	22.0	20	4	.63	11.2	26.2	20	4	.615	11.5	25.5	20	3	.855	8.3	20.1	20	4	.61	11.6	29.6	20	4
J			2.0	.155	12.9	24.1	20	3	.24	8.3	22.4	20	4	.30	6.7	15.2	15	4	.24	8.3	19.4	20	4	.235	8.5	18.9	20	3	.25	8.0	19.4	15–20	4	.195	10.3	26.3	10–15	4
K			2.0	.135	14.8	27.7	15	3	.21	9.5	25.7	20	3	.33	6.1	23.8	20	4	.23	8.7	20.3	18	4	.22	9.1	20.4	20	3	.295	6.8	16.4	15–20	4	.225	8.9	22.7	10–15	4

Tests A to K inclusive are passenger cars; L to Q are trucks.

Results of Exhaust Gas Analysis Made on Each of the Cars

Per Cent. of	CO_2	CO	O_2	CO_2	CO	O_2	CO_2	CO	O_2	CO_2	CO	O_2	CO_2	CO	O_2	CO_2	CO	O_2	CO_2	CO	O_2
1	11.1	2.4	0.4	9.1	4.4	1.0	5.2	5.1	4.2	6.5	2.6	5.5	6.5	4.7	2.8	6.5	3.4	2.9	8.0	1.6	4.4
2	13.6	0.0	0.6	11.1	2.4	0.3	7.0	4.6	0.9	7.9	2.8	3.1	9.8	1.4	2.1	......	......	......	12.7	0.8	0.2
3	13	2.5	0.3	10.6	2.5	0.2	5.8	5.7	0.9	8.6	3.5	1.8	10.4	1.6	0.8	6.1	3.6	1.5	11.8	0.9	1.0
4	8.6	2.6	0.6	......	......	......	5.3	6.8	0.5	8.2	4.2	0.4	10.2	2.6	0.3	6.6	4.1	0.7	11.8	1.0	0.3
5	13.8	1.5	0.4	9.2	4.2	0.2	7.6	4.3	0.4	9.2	4.2	0.3	13.3	0.0	0.9	6.9	3.8	0.4	12.0	1.1	0.2
6	11.8	0.1	0.2	8.0	4.3	0.4	6.8	6.1	0.6	9.2	2.9	0.5	11.0	0.0	2.6	7.6	3.7	0.6	11.6	1.4	0.2
7	12.9	1.0	0.0	9.9	3.6	0.3	7.4	4.7	0.4	8.6	3.9	0.3	12.0	0.0	3.0	7.7	3.6	0.3	10.8	1.7	0.2
8	13.0	0.8	0.1	6.6	6.8	0.4	8.3	3.6	0.5	10.3	2.3	0.2	11.6	0.0	3.5	8.6	3.0	0.4	8.8	2.6	0.3
9	11.8	1.2	0.2	6.4	6.8	0.4	7.2	4.4	0.8	10.4	2.2	0.0	10.3	0.0	4.0	6.9	3.6	0.4	8.8	2.9	0.3

Positions of Throttle and Spark, Gear Used, R. P. M. of the

Test Number	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour
1	⅛	...	..	Full	0	...	...	....	Fu.Ad.	0	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
2	¼	1–3	..	Adv.	0–10	...	1–3	300 364	"	0–10	....	1–3	....	....	0–10	....	0–3	....	....	0–10	....	1–3	....	....	0–10	....	0–3	....	....	0–10	....	1–4	...	.....	0–10
3	¼	3	..	"	10	...	3	364	"	10	....	3	345	....	10	....	3	....	....	10	⅛	3	275	¾ A	10	⅛	3	....	....	10	⅛	3	...	.....	10
4	½	3	..	"	15	...	...	....	"	....	....	3	518	....	15	....	3	684	....	15	¼	3	414	¾	15	⅛	3	....	....	15	3–16	4	...	.....	15
5	⅝	3	..	"	25	...	3	910	"	25	....	3	690	....	20	....	3	910	....	20	....	3	550	¾	20	⅛	3	....	....	20	¼	4	...	.....	20
6	¾	3	..	"	30	...	3	1090	"	30	....	3	1035	....	30	....	3	....	....	30	....	3	825	....	30	¼	3	....	....	30	⅜	4	...	.....	30
7	Full	4	..	"	35	½	4	544	"	20	....	3	690	....	20	....	4–3	910	....	20	½	3	550	½	20	½	4	....	....	20	⅜	4	...	½ A	20
8	¾	2	..	"	20	2–3	2	1160	"	20	....	2	1024	....	20	....	2	1180	....	20	⅝	2	1000	¾	20	¼	2	....	....	20	¼	2	...	½	20
9	Full.	2	..	"	14	½	2	1160	"	20	....	2	1024	....	20	....	2	....	....	20	Full	2	1000	¾	20	¼	2	...	F A	20	½	2	...	½	20

L—Nearly level. M—Up and down grade. N—½ level, ½ down grade. O—Down grade.

sis Tests Made for THE AUTOMOBILE

SPECIFICATIONS OF CARS — TRUCKS

8	9	10	11	12	13	14	15
Clear	Clear	Clear	Clear	Clear	Clear	Cloudy and clear	Clear
80 degrees	80 degrees	67 degrees	74 degrees	72 degrees	64 degrees	76 degrees	75 degrees
29.96	29.8	30.02	30.12	29.96	30.01	30.22	30.22
38 per cent.	60 per cent.	48 per cent.	47 per cent.	60 per cent.	50 per cent.	62 per cent.	90 per cent.
0.925	2.19	2.01	2.32	1.66	11.07	3.96	7.79
30x3	36x4½	36x4½	37x5½	34x4	42x5 dual	39½x4 dual block	39½x4 dual block
30x3	36x4½	36x4½	37x5½	34x4	36x6 (single)	36x6 dual block	36x6 dual block
60	85	85	90	80	Solid rubber	Solid rubber	Solid rubber
55	85	78	90	80	Solid rubber	Solid rubber	Solid rubber
13	11	12	10.08	.....	42.65	24.34	24.34
4	5½	5.57	5.7	7.05	21.85	14.8	14.8
.....	3½ (direct)	3.3 (direct)	3 (direct)	3.45 (direct)	13.9	8.64	8.64
.....	.....	.....	.....	.....	.....	.....	.....
1	2	2	2	1	2	2	2
Hot	Hot for 1st jet; cold for 2d	Cold	Hot	Hot	Cold	Cold	Cold
No	Yes	Yes	(Not used)	No	Yes	Yes	Yes
3½x3½	4½x5½	4½x5	5x4½	4½x4½	5x6	4½x6	4½x6
4	4	4	6	4	4	4	4
One side	Sliding	Head	Head	One side	One side	One side	One side
Over inlet	Head	Side	Side	Over intake	Over inlet	Over inlet	Over inlet
One	One	One	One	One	One	One	One
Splash	Splash and Pump	Pump	Pressure	Splash	Grav. and Pump	Pressure	Pressure
.....	Centrifugal	Centrifugal	Centrifugal	.....	Centrifuga	Centrifugal	Centrifugal
.....	.....	.....	.....	.....	.....	.....	.....
Ther. Syphon	H. T.	H. T.	H. T.	Ther. syphon	H. T.	H. T.	H. T.
H. T.	Bosch	Bosch	Bosch	H. T. Duplex	Bosch	Bosch	Bosch
Bosch				Bosch			

Per Gallon and Miles Per Hour of Each Passenger Car and Truck

Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Trans. Gear No.	Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Trans. Gear No.	Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Trans. Gear No.	Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Trans. Gear No.	Gals. Gas.	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Transmission Gear No.	Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Transmission Gear No.	Gals. Gas	Miles per Gal.	Tons Miles per Gal.	Miles per Hr.	Trans. Gear No.
.065	20.8	18.9	12	2	.075	17.7	38.8	10–15	2	.11	12.1	24.3	15	3	.16	8.3	19.3	10–15	2–3	.11	12.1	12.1	10–15	2–3	.92	3.8	42.1	7–10	2–3	.635	5.5	21.8	15	3	.70	5.0	39.0	14	3
.17	22.1	20.4	15	2	.245	15.3	33.5	15	3	.32	11.7	23.5	15	3	.31	12.1	28.1	15	3	.22	17.0	28.2	15	3	.42	2.8	31.0	3–2	10–5	.31	3.8	15.0	7–14	2–3	.30	3.9	30.4	14–6	3–2
.095	18.2	16.8	15	2	.16	14.9	32.6	20–15	2–3	.16	14.9	29.9	20–15	2–3	.215	11.1	15.7	15	3	.14	17.0	28.2	15–20	3–2	.455	3.8	42.1	3	10	.30	5.8	23.0	14	3	.36	4.8	37.4	14	3
.04	18.7	17.3	30–20	2	.08	9.4	20.6	20–30	3	.085	8.8	17.7	20	3	.10	7.05	16.4	20–30	3	.065	11.5	19.1	30–20	3	.29	6.9	76.4	3	10	.35	5.7	22.6	14	3	.18	11.1	86.5	14	3
.035	28.6	26.4	15	2	.065	15.4	33.7	15	3	.06	16.7	33.6	20	3	.085	11.8	27.4	20	3	.075	13.3	22.1	15	3	.29	13.8	15.3	2	5	.16	2.5	9.9	6	2	.....	.....	.....	10–4	3–1
.055	11.6	10.7	15–18	1	.10	6.4	14.0	15–20	3	.11	5.8	11.7	15–20	2–3	.185	3.5	8.1	20	3	.095	7.1	11.8	20	3	.85	4.6	50.9	3	10	.605	6.4	25.3	14	3	.61	6.3	49.1	14	3
.09	26.7	24.7	20	2	.135	17.8	39.0	15–20	3	.13	18.5	37.2	20	3	.18	13.3	30.9	20	3	.14	17.1	28.4	20	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.06	7.8	7.2	15	1	.105	4.5	9.9	20	2	.135	3.5	7.0	20	2	.16	2.9	6.7	20	2	.095	4.9	8.1	20	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.355	27.7	25.6	20	2	.455	15.5	13.9	20	3	.51	13.9	27.9	20	3	.545	13.0	30.2	20	3	.62	11.4	18.9	20	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.09	22.2	20.5	15	2	.185	10.8	23.7	15–20	3	.17	11.8	23.7	15–20	3	.20	10	23.2	15–20	3	.16	12.5	20.8	15	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.11	18.2	16.8	15–18	2	.190	10.5	23.0	15–20	3	.18	11.1	23.3	15–20	3	.26	7.7	17.9	15–20	3	.19	10.5	17.4	15	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

and Trucks Showing the Percentage of the Various Gases

CO_2	CO	O_2	CO_2	CO	O_2	CO_2	CO	O_2	CO_2	CO	O_2	CO_2	CO	O_2	CO_2	CO	O_2	CO_2	CO	O_2	CO_2	CO	O_2	CO_2	CO	O_2
6.2	1.8	8.2	13.4	0.0	1.4	11.2	0.7	2.1	8.3	2.3	1.6	9.3	2.3	0.7	9.2	1.0	4.6	9.5	0.9	3.9	2.6	2.1	10.8
8.7	2.4	1.4	10.6	1.1	0.9	10.0	1.8	0.9	9.3	2.4	0.2	9.9	1.6	0.9	11.2	1.9	0.2	12.0	0.0	2.3	10.6	1.5	1.0
5.4	3.4	3.0	12.6	0.0	1.2	11.7	0.4	1.7	9.3	2.3	0.2	11.0	1.1	0.3	12.4	1.2	0.0	13.3	0.4	0.0	12.4	0.5	0.6
6.5	3.5	1.3	13.1	0.0	1.5	12.1	0.7	0.7	9.4	2.6	0.2	12.8	0.2	0.4	10.3	2.1	1.0	13.8	0.1	0.0	11.6	1.1	0.8
6.5	3.5	1.1	13.4	0.0	1.6	12.1	0.8	0.7	11.3	1.5	0.0	13.7	0.0	1.2	10.4	2.3	0.2	13.4	0.3	0.6	11.2	0.0	4.1
7.8	2.8	0.8	9.7	1.6	0.7	5.6	4.2	1.4	9.4	2.5	0.2	11.7	0.0	3.7	10.6	1.4	1.4	13.6	0.0	1.0	12.8	0.3	0.7
11.0	1.2	0.4	8.6	2.1	1.0	9.3	2.2	0.6	6.4	4.3	0.2	12.4	0.4	0.3	9.6	2.6	0.4	13.6	0.0	1.1	12.7	0.0	2.5
10.8	1.3	0.8	13.1	0.0	0.7	9.3	2.3	0.4	5.8	4.0	0.2	12.7	0.2	0.6	9.2	3.0	0.2	11.9	0.2	1.8	.....	.....	.....	.....	.....	.....
11.9	0.9	0.3	11.0	1.0	0.5	11.1	1.8	0.3	8.0	3.3	0.2	13.2	0.0	0.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Motor and Speed in Miles Per Hour for the Different Tests

Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour	Throttle	Trans. No.	R.P.M. Motor	Spark Posit.	Speed, Miles per Hour
.....	1–2	.....	.....	0–10	¼	1–2	.....	.....	0–10	⅛	1–2	.....	¾	0–10	⅛	2	.....	¾	0–10	¼	1–2	.....	½	0–10	¼	1–3	.....	.....	0–10	¾	3	.....	.....	11	.....	1–3	.....	.....	0–10
.....	2	.....	.....	10	¼	2	.....	.....	10	¼	2	.....	¾	10	1–12	3	.....	¾	10	¼	2	.....	½	10	.....	2	.....	.....	7	Full	3	.....	.....	7	Full	3	.....	.....	14
.....	2	.....	.....	15	3–16	3	.....	.....	15	⅛	3	.....	¾	15	⅛	3	.....	¾	15	¼	3	.....	½	15	.....	1	.....	.....	2	"	2	.....	.....	10	"	2	.....	.....	7
.....	2	.....	Fixed	20	3–16	3	.....	.....	20	⅛	3	.....	¾	20	⅛	3	.....	¾	20	¼	3	.....	½	20	.....	3	.....	.....	10	.....	2	.....	.....	5	½	3	.....	.....	10
.....	2	.....	.....	30	¼	3	.....	Full	30	⅛	3	.....	¾	30	⅛	3	.....	¾	30	¼	3	.....	½	30	Full	2	.....	.....	5	.....	3	.....	.....	10	Full	2	.....	.....	6
Full	1	.....	.....	15	¼	3	.....	"	15	⅛	3	.....	¾	20	⅛	3	.....	¾	20	¼	3	.....	½	20	"	3	.....	.....	10	.....	2	.....	.....	6	"	3	.....	.....	14
"	2	.....	.....	20	¼	3	.....	"	20	⅛	2	.....	¾	20	⅛	2	.....	¾	20	¼	2	.....	½	20	"	2	.....	.....	5	.....	.....	.....	.....	.....	¾	1	.....	.....	4
"	1	.....	.....	15	¼	2	.....	Full	15	⅛	2	.....	¾	18	⅛	2	.....	¾	20	¼	2	.....	¾	20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

P—Up steady grade. Q—Nearly level. A—Advanced. FA—Fully advanced.

have been lost in power so that the adjustment was to some extent a compromised one, and all things considered a good one.

Car No. 2 Lower Ton-Mileage

Take now No. 2 car of the same make and general design as No. 1 except that it has a six-cylinder motor of 4 1-4 inch bore by 4 3-4 stroke. The record of gas analysis shows that the mixture was too rich for good economy and probably for best power. In only one case was there as much as 1 per cent. of O_2 in the exhaust, whereas the CO averaged nearly 4 per cent. and CO_2 only 9 per cent. Here it is evident that there was a marked deficiency in the air supply. The result is a loss of about 17 per cent. of the fuel due to incomplete combustion. Now since cars Nos. 1 and 2 are very similar in design and other particulars it would seem reasonable to expect that the better combustion which took place in Car No. 1 as compared to No. 2 would be roughly manifested in the relative distance they would travel per ton weight with a given consumption of gasoline. Examining this point we find that Car No. 1 made 31 ton-miles per gallon while Car No. 2 traveling over the same ground made but 26.6 ton-miles per gallon. The exhaust from neither of these two cars contained any considerable quantity of CO coincident with the occurrence of O_2 in sufficient quantity to burn the CO to CO_2. This indicates excellent diffusion of the gasoline in the air.

No. 3—Not Enough Air

In the case of Car No. 3 a glance shows that the combustion is very poor and that there is not sufficient air present to permit much more than one-half the carbon to burn completely. With this in view it is not surprising that the car averaged less than 7 miles per gallon or 15.3 ton-miles per gallon. It is evident that a considerable increase of air properly mixed with the gasoline would have cut down the consumption of this car to a very marked degree.

Good Combustion when Idling

Conditions in Car No. 4 are similar to those in No. 3 although the waste of fuel is not so marked. A sufficient quantity of air for complete combustion was not present at speeds of 15 miles per hour and above. At lower speeds and when the motor was idling sufficient air was present for complete or at least better combustion, but the gas was evidently not well mixed, else CO and O_2 would not have been found together in the exhaust.

This car made 8.7 miles per gallon or 20.4 ton-miles per gallon, a record which could have been bettered with better combustion.

More Air Needed when Idling

The analyses of gas from Car No. 5 show that fairly good combustion was obtained, except with motor idling, at 15 miles per hour and below, while at higher speeds and when the car was climbing a grade the combustion was still better. The sample at 30 miles and those at 20 miles on grades showed some excess of air without any CO indicating a lean mixture and good combustion when throttle was well opened. This car made 11 miles per gallon and 22.3 ton-miles per gallon.

Poor Mixing at Low Throttle

Car No. 6 which had a six-cylinder T-head motor shows a performance very similar to No. 3 in so far as the gas analyses are concerned, and we are therefore not surprised to see a similar record of 7 miles per gallon or 16.9 ton-miles per gallon. There are indications of poor mixing at low throttle and of insufficient air at speeds above 15 miles per hour.

No. 7's Troubles when Idling

In the case of Car No. 7 the CO_2 content was fairly high except with the motor idling or pulling up a grade with throttle well opened. When idling the vaporization was not good for 1.6 per cent. CO was found together with 4.4 per cent. O_2. While the car was accelerating and while running on the level at speeds of 10, 15 and 30 miles the combustion was excellent, there being an average of about 12 per cent. CO_2, 1.5 per cent. CO and only a trace of O_2, conditions which indicate a maximum power setting with a ratio of air to gas of about 13 to 1. With wider throttle opening the mixture was evidently rather rich showing about 9 per cent. CO_2 and 2.7 per cent. CO with only a trace of O_2. Although large and heavy, this car made 9.4 miles per gallon and 23.9 ton-miles per gallon. When compared with the records of car No. 6 which was in about the same class with respect to cost, weight, and power, both these results speak volumes. They show no less than 34 per cent. increased mileage due in large part at least to better combustion resulting from proper proportions of air to gas and good carburetion as compared to an over-rich mixture and faulty carburetion.

35 Ton-Miles Possible

Car No. 8 was a light car with a small L-head motor 3 1-4-inch by 3 3-8, which should show good mileage with proper carburetion. But the record of gas analysis is poor yielding high CO, low CO_2 with O_2 present, in sufficient quantity for more perfect combustion in some cases (indicating imperfect mixing) though forming less than 1 per cent. of the total mixture in other cases. In spite of this showing this car made 22.3 miles per gallon or 21.2 ton-miles—seemingly a fairly good showing. Yet when it is considered that really good carburetion should give well over 35 ton-miles with such a car the discrepancy is rather startling.

Non-poppet Engine Is Economical

Car No. 9 had the only non-poppet valve engine tested. If the ideal shape of combustion chamber is the nearly spherical one without jackets, then that of a Knight engine approaches the ideal very closely. Such being the case, one might expect more perfect combustion in all Knight engines than in L-head or T-head engines were it not true that proper carburetion is by far the most important factor in producing perfect combustion—so important, in fact, that it is decidedly doubtful whether the effect of the form of the combustion chamber could be detected amid the numerous other peculiarities of different types of motors, especially when tested on the road. In this instance, however, the analysis was excellent, except in one or two cases. Unlike most of the analyses thus far discussed, this one shows the evidences of a lean mixture—absence of CO, high (12 to 14 per cent. of) CO_2 and some excess O_2. By reference to the rules given above, we find that this proportion of constituents is about right for high economy. The curves, Fig. 2, show that the air to gas ratio is about 15 to 1, hence we may expect good mileage from this car. The gas consumption record shows an average of about 13.3 miles per gallon, or 29 ton-miles per gallon, the best record of any pleasure car except No. 1, which was a lighter car. This, as stated above, cannot be credited in large part to the engine, but rather to the carbureter, which furnished a proper mixture for high efficiency.

Too Rich Mixture Supplied

Car No. 10 had a four-cylinder valve-in-the-head motor of about the same size as the Knight motor in Car No. 9. The shape of the combustion space in both these motors is approximately the same, both being free from pockets. Both were fitted with the same make of carbureter, and both had similar inlet manifolds. It is not surprising, then, to find the gas analysis and the fuel consumption per ton-mile about the same. In both cases the poorest combustion was obtained at speeds of about 30 miles on the level. The carbureter setting for Car No. 10 was such as to give a rather rich mixture, however, and it is probably due to this fact that the ton-miles per gallon are about 15 per cent. lower than with Car No. 9—namely, 24.3 ton-miles per gallon, instead of 29 ton-miles.

No. 11 Shows 23 Ton-Miles

Car No. 11 had a six-cylinder motor with valves in the head. The gas analysis showed that the carbureter has been set for a rather rich mixture. In only one case was there more than a trace of O_2 in the exhaust, while the CO ran up to 4.3 per cent.

(*Continued on page 469.*)

Lathe for large production by the Cincinnati Lathe & Tool Co.

High-Speed Lathe Means Economy

Heavy-Cutting Machine Contributes to Production

THE lathe shown on this page is capable of taking a .875-inch cut on cast iron with a 3-32-inch feed at a speed of 85 feet per minute, according to tests made by the manufacturers, the Cincinnati Lathe & Tool Co., Cincinnati, O. When used on steel the makers state that some of these lathes actually in use in automobile work are machining 60-point crucible steel at 70 feet per minute and take a .75-inch cut with a 1-16-inch feed.

This lathe represents the latest developments in engine lathes produced by the Cincinnati company. It is made of particularly rigid structure to avoid any tendencies towards disalignment on account of the strains due to taking deep cuts in material of great toughness. The manufacturers mention examples of this work and state that they have on hand a chip 30 feet long that was taken by one of these lathes from a 40-point tool steel bar. The chip shows a cut .5 inch in depth made by the machine operating at a speed of 75 feet per minute.

Deep cuts in the steels used in automobile manufacture are difficult to obtain but lathes which will successfully do this represent an economy of which the automobile manufacturer who is turning out his work in quantities is well aware. The amount of work turned out per unit machine is so important in these larger plants that the expense of new equipment is soon paid for by the saving of time, space and men.

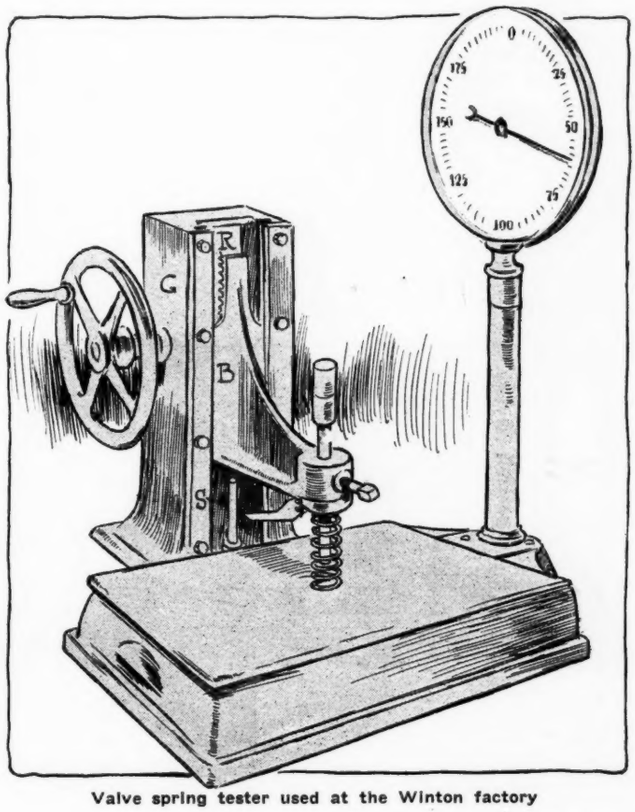
The lathe shown in the illustration can be adapted to any particular cases where this class of work is desired. For instance, where semi-automatic action is required, these lathes can be fitted with two tool posts. They can also be supplied with friction double back gears.

Valve Spring Testing

ONE of the factors having an important bearing on the smoothness of running of the gasoline engine is the correct degree and uniformity of tension of the valve springs. If one spring is weaker than the others it is impossible to have perfectly even running or efficient operation owing to the difference in valve opening and closing. For this reason it is customary in assembling the engine to test every valve spring. At the Winton factory the machine used for this purpose, shown in the accompanying illustration, is simple, accurate and enables the springs to be tested in the shortest time, a few seconds sufficing for each spring.

This tester is really an adaptation of an ordinary small platform weighing machine with dial and pointer. Behind this is arranged a strong upright which is provided with guides in front for the sliding bracket B. A handwheel with a pinion on the inner end of the shaft is the means of raising and lowering the bracket, the latter having a toothed rack R behind, running on the pinion. Before testing, the stop S is adjusted so that the bracket in its lowest position is compressing the spring to exactly the length it will assume in the engine when operated by the cam. Testing is then accomplished by simply placing the spring in position, giving the wheel a turn until the bracket touches the stop and noting the pressure on the platform as indicated on the dial. The requisite pressure varies according to the particular design of engine. Between 60 and 65 pounds are ordinary pressures.

The stop which determines the height of the spring when compressed is the only adjustment on the machine.



Valve spring tester used at the Winton factory

The Need for a Cyclecar Motor

Development of the New Vehicles Requires a Cheap, Efficient, Reliable and Well Balanced Engine of Not Over 71-Inch Capacity—Possibilities for Economy—New Cooling System Needed

By William B. Stout

THE future of the cyclecar depends on the development of a cheap, reliable, efficient, well-balanced motor of not over 71-inch capacity, and it is not improbable that the very demand for cheapness and simplicity may lead to the adoption of some type of four-cylinder motor.

Present motors as used on cyclecars are surprisingly efficient and fairly well balanced, but while the twin cylinder V-type motor sounds simple, the present constructions are too expensive to continue as cyclecar possibilities. Some of the present V motors have more parts than a four and hence are less reliable. Their weight is about what is wanted—not over 100 pounds, but engine makers say that they can build fours with water cooling which will not weigh more. If this be so, and the cost is less than the V, then four-cylinder motors will come. The cyclecar is a cost proposition.

Chief Trouble Is With Rings

The chief trouble with the small motor is rings. If those in a cylinder under 2 3-4 inches diameter are made as stiff as they should be to stand up to the work and hold the gas, then they are too rigid to spring over the piston and into the grooves without distortion or breakage. If they are thin enough to slip over without distortion or breakage then they are not stiff enough to hold up to the work. This is especially true on air-cooled motors where the rings are subjected to great heat.

Fig. 2 shows three ways in which this difficulty may be overcome, the first by screwing an apron A up over the piston head which supports the piston pin, this apron screwing up to hold the two rings in their sockets so that they do not need to be sprung into place. The second shows how the rings with a spacing ring between can be slipped into place and a plate B riveted down on top to hold them in place, a type used when magnalium is the piston material. The third is a type where the cylinder head C screws into the piston. This type can support the piston pin as first shown but is better if the pin bearings are hung as at D from the screwed-in head.

There are a number of reasons why a four-cylinder motor should be cooled by some external system other than air-cooling. In the first place air-cooled cylinders take up space and hence add a certain amount of weight. By casting in block also four water-cooled cylinders can be made cheaper than air-cooled cylinders. It is very difficult to cool the third cylinder of an air cooled motor, the rings on this cylinder wearing out very quickly. This is no problem on the water cooled. With the block type the entire motor can be largely in one piece, cylinders, crankcase, intake and water jackets, and in these small-length castings the exhaust as well and the valve housings and water leads can be included. Crankcase cover plates can be pressed steel as can also be the lower half of the crankcase, to save weight. These castings can be made as thin as 1-8 inch and hence the block casting say in semi-steel will weigh no more than an air-cooled outfit of the same capacity.

Bearings Should Be Plain

The bearings should be plain on account of noise. A ball bearing in a motor reverberates all through a cyclecar, giving a roaring sound from the body when the motor is in action. With the plain bearings a force feed oiling system is advisable. The bore-stroke ratio for this work should be in the neighborhood of 1 to 1 1-2 and the connecting-rods long in proportion, as the small pistons have little surface to take the side thrust.

Small pistons and rods allow of very light weight and these should be of the very best quality. The best of steel will allow of very light connecting-rods while featherweight pistons are an everyday occurrence nowadays. Balance will be a real problem in these little motors which will be running often at 3,500 revolutions per minute, and which will have to be built to stand speeds of this or even higher rotation for sustained periods.

For the small motor of ultra-efficiency overhead valves have great advantages, and can be made very quiet as well.

This type of valve, driven by an overhead camshaft, as on the Weideley motor for instance, can be inclosed and run in oil, insuring perfect lubrication and absence of click, and the cams can act directly on mushroom tops to the valves. The valves need not be large, for a flat valve in this small size will hold the gas excellently and can be made self cleaning. A flat valve will pass a great deal more gas than a beveled faced valve for the same opening as in Fig. 1 and hence has great advantages for quick opening and closing or for noiselessness. This type operated by the overhead camshaft would be very cheap to build. The valves also could be faced in the same operation of reaming the cylinders. This construction too, would allow the entire valve seat to be surrounded by water, as in Fig. 4, a point which will add greatly to valve life.

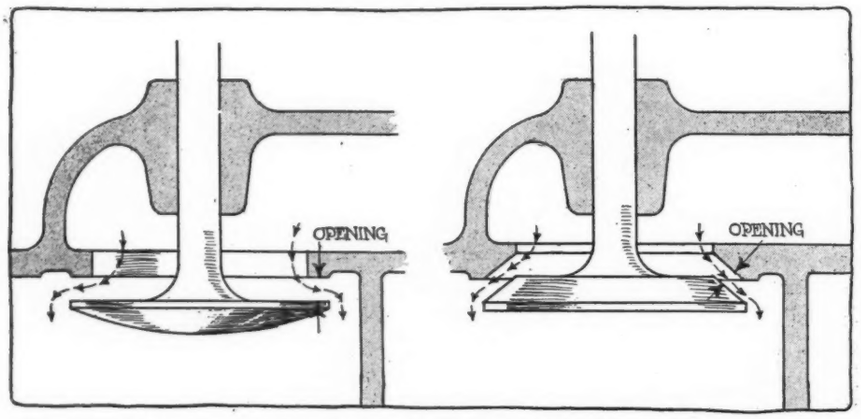


Fig. 1—Flat valves give greater opening for the same valve lift and have greater possibilities for high-speed work

In overhead valve construction there should be no possibility of valves breaking and falling into the cylinders, so that valve stems should be extra large and the material of the best. The design may include pockets to catch the valve if it does fall, but a cheaper way is to allow the strength of stem that will preclude breakage.

Economy in Castings

The intake passage can pass through the water jacket, and, as stated, the exhaust manifold can be unit with the main casting. The bearings should be in the upper half of the crankcase, so that the removal of the bottom of the crankcase or of the engine from it will not disturb the assembly.

The cooling of a cyclecar motor will be different from that on big cars and it is possible, and almost probable, that the eventual motor will water-cool without the expense of radiator connections, or possibly even of radiator. A development of hopper cooling as used on farm engines will be one line of growth and a thoroughly reliable one, having the advantage of running the motor at a higher heat than on present motor car types, an advantage with the present grades of gasoline.

In hopper cooling as in Fig. 3 at A, plenty of water space is allowed around the cylinders and at the top a large outlet with a funnel shaped opening is left. The water in the jackets can never get hotter than the boiling point and hence the cylinders work always at this even temperature. When the water boils away more is poured in to take its place, when stops are made for gasoline.

To use this as in farm engines might require too much weight of water though air fins on the outside of the hopper would save a great deal through radiation of the water heat.

To catch the water in a condenser above the motor, even though this were but in the form of a tank at front or better at the rear of the car would be to save a great deal. This water after cooling could be arranged to flow back into the motor again. A form of this system is shown at B where M is the motor, C an open condensing tank of sheet metal. For ordinary running the tank area would cool the water enough to return it to the hopper and when heavy pulling made it boil beyond the capacity of the crude condenser then the overflow of steam could be conducted below by the pipe E leading from the top of the condenser tank C to a point under the car. Motors of this type have been used in aeroplanes with good success, the Antoinette machine using a motor of this type, using condenser instead of radiator.

At D in Fig. 3, is shown a method of clamping the radiators on the side of the cylinders, this making an ideal and compact thermo-syphon system with minimum parts and weight, the idea being used on the Green engines of British manufacture used for motorcycles. This form can be made to merge into the hood design very handily.

There is need for a new cooling system for cyclecars and to fit the heat requirements of present day gasoline. On the development of proper pistons for small sized motors and adequate cooling systems at less cost and weight than present types depends the success of the four-cylinder motor on cyclecars. The weight should be under 100 pounds complete with water, and the cost under $75 in quantities. If a motor can be built to sell for $50 as is easily possible without skimping workmanship, it will have just that much greater field.

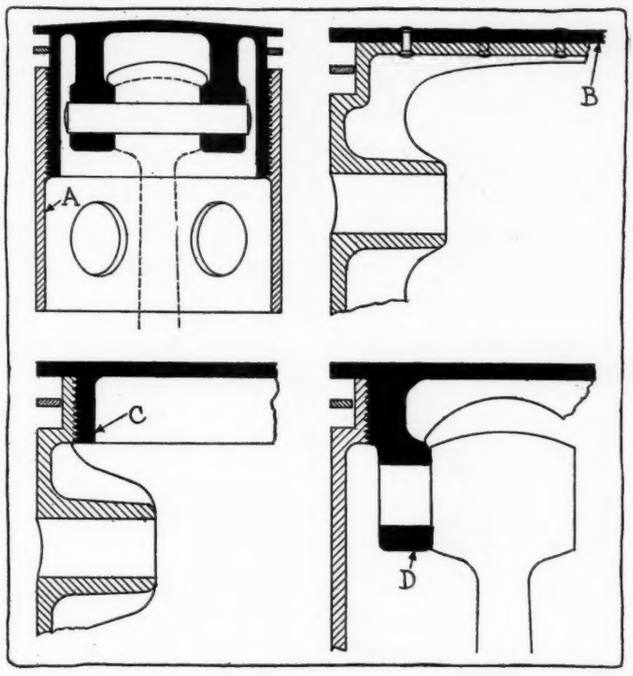


Fig. 2—Piston types for small diameters allowing application of rings without springing

The crankshaft of a cyclecar motor can be of the two bearing type on account of the short length of the motor. The connecting-rod bearings, however will need to be larger in proportion than on a big car motor and the oiling systems for the whole machine will need to be perfect. A splash system with a constant level overflow supply will work very well so far as the cylinders are concerned and the connecting-rod bearings, better by far than in a big motor where the distance is higher and the revolutions per minute lower, the main bearings will need special oiling, however, and plenty of it.

Ignition can be by magneto, but battery systems today are so reliable and give such wonderfully easy starting that coupled with a lighting system for less price than the magneto, they are likely to continue. They weigh less and cost less.

Foor or hand starters will be used in all cyclecars, these arranged so that they can be operated from the seat.

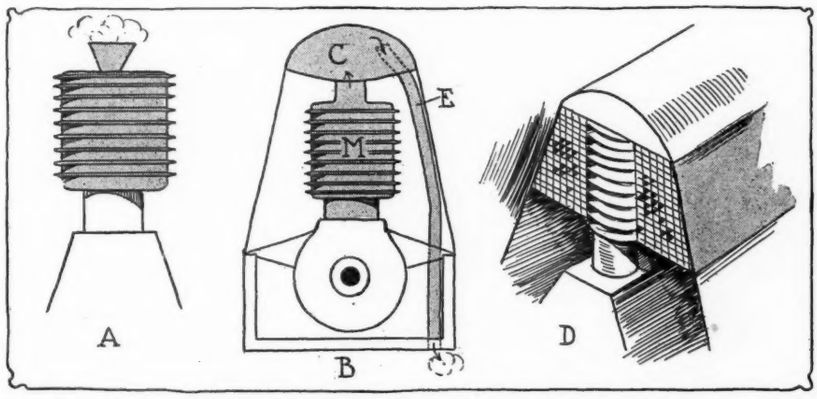


Fig. 3—A, hopper cooling; B, addition of condenser to hopper cooling; D, compact arrangement of radiator along cylinder walls

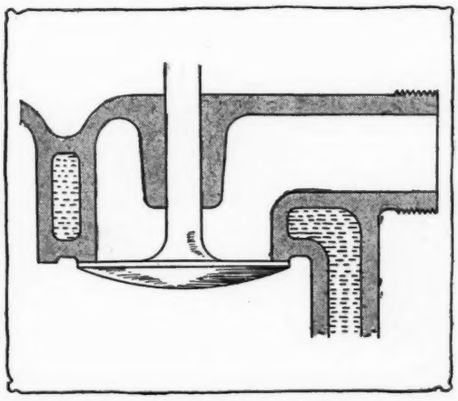


Fig. 4—The entire seat of the overhead valve can be directly cooled by waterjackets

The Automobile Engineers' Forum

Lozier, Paterson and Grant Engineers Find Detachable Cylinder Head Type of Construction Facilitates Production Besides Promoting Accessibility—Reader Criticises Ideas Expressed in Shock Absorber Communication

DETROIT, MICH.—Editor THE AUTOMOBILE:—In bringing out our new four cylinder car to sell at $2,100, we realized that, in order to get a car of quality and serviceability, it would be necessary to get the cost down by simplicity of construction as well as increased production. We therefore adopted in our engine design a form of construction we had used in the days when we were making marine engines, for in these times of copper-asbestos gaskets a detachable cylinder head is entirely safe and practical, and is very desirable for accessibility of valves. The compression space can be kept very uniform in the different cylinders, as the compression space is obtained entirely by green sand cores.

Of course, this design of head is almost necessary, to accomplish the results we are after in making an engine power plant which will be as compact as possible, and working towards this end, we have incorporated a portion of the crankcase with the cylinder casting, and also by incorporating the upper water manifold in the cylinder head, the machine work on the cylinder is facilitated.

By adopting features like these the four-cylinder engine can be made with the approximate advantages of the six and still retain the numerous advantages of the four over the six as regards a general utility proposition.—J. G. PERRIN, Chief Engineer, Lozier Motor Co.

Detachable Cylinder Heads Convenient and Do Away with Leaky Valve Plugs

FLINT, MICH.—Editor THE AUTOMOBILE:—We find the type of construction comprising detachable cylinder heads very convenient in removing the various parts for repairs, such as pistons, piston rings, connecting-rods and connecting-rod bearings. It is also very convenient for removing the carbon and grinding in the valves. It does away entirely with leaky valve plugs and gives more cooling space and better cooling. We also find in machining cylinders from one setting that they are much more accurate. —A. L. LATHROP, Chief Engineer, W. A. Patterson Co.

Saving in Machine, Foundry and Assembly Work with Detachable Heads

FINDLAY, O.—Editor THE AUTOMOBILE:—The advantages of detachable cylinder head construction are as follows:

A material saving in machine, foundry and assembly work is gained by the use of this construction without sacrificing any of the claimed advantages of a non-removable cylinder head. It is thus by the elimination of unnecessary work and simplicity of design, that we are able to build a car containing all the conventional units entering into the construction of a high priced car, and sell the same for $495.

It has been found by experience that when the user wishes to regrind his valves he usually at the same time wishes to remove any carbon that may be present from the inside of the combustion chambers. The removable cylinder head as used on the Grant separates at the level of the valves. Thus the valves are readily accessible, and it is a very easy matter indeed to grind and remove the carbon from the inside of the cylinder heads. The cylinder bores may also be inspected, and the tops of the pistons, which project slightly above the cylinder casting, when moved to their upmost position, may be easily cleaned. Removing the cylinder head is a very simple matter, as the removal of a few nuts from the top of the engine permits the cylinder head to be lifted upward and off.

The only disadvantage of this construction, looking at it from a most critical standpoint, is that the valves may not be ground without removing the head, but as this is easily accomplished, and necessary only once or so a season, we believe it is greatly overshadowed by the accessibility of the valves and ease of cleaning the combustion chambers without having to use the expensive oxygen method, or an injection of a carbon remover.—JAMES M. HOWES, Chief Engineer, Grant Motor Co.

Some Shock Absorbers Tend To Hold the Wheels Off the Road

WAVERLY, ILL.—Editor THE AUTOMOBILE:—In the discussion as to the effect of shock absorbers in the January 29 number of THE AUTOMOBILE, J. P. Baldwin, in stating that "vehicle springs in extending must of necessity exert the same force downward that they do upward" evades the point that *less* force is exerted in either an up or down direction by a dampened spring recoil. The shock absorbing qualities of these devices are due to the checking of the upward movement of body by means of this decreased rebound force. The decrease of the downward rebound on axle must be equal. In other words it seems that the upward rebound of body may not be checked without also checking the tendency of the axle to regain its normal position.

Moreover, both the upward movement of body of car, and also the tire strain produced by a wheel mounting an obstacle, is greater when the compression of the spring is dampened, since the action of the spring is stiffened thereby. If this increased upward movement of body is neutralized by the action of the shock absorber, there is yet nothing gained so far as the comfort of passengers is concerned, and it is possible to check this upward movement only at the expense of retarding the movement of the axle to its normal position where it would regain its normal hold upon the road.

It should not be inferred from this that all the tendency of the wheels to leave the road after passing over an obstruction is due to shock absorbers of this type, but that they add to it in an unnecessary degree, since it is possible to construct absorbers that effectually absorb shocks, and yet do not add to this tendency.—T. S. HARRIS.

Thinks Piston Displacement Was Ignored in Power Comparison

NEW YORK CITY.—Editor THE AUTOMOBILE:—I have just read the article in THE AUTOMOBILE for February 5 written by Paul Hale Bruske of the Studebaker Corp.

There is no disputing Mr. Bruske's statement that a six-cylinder motor delivers a more "continuous stream of power" than the four, but, on the other hand, I do take exception to his statement in the third and second paragraphs from the end of his letter, in which he refers to the power curves of a four and a six-cylinder motor of the "same cylinder dimensions and general design." I judge that by specifying the "same cylinder dimensions" Mr. Bruske means that the bore and stroke of each

motor are equal, one being a six and the other a four. Now, he goes on to say that the most interesting feature in his diagrams, showing the power curves of the two motors, is that the curve of the six shows considerably more average power than that of the four and consequently the "six motor's superiority being so plainly superior as to banish all chance of argument." Surely the fact that a six-cylinder motor of the same bore and stroke as a four-cylinder motor of similar design gives more power than the latter is no argument for claiming the superiority of the six. The six-cylinder motor has 50 per cent. more piston displacement, and why should it not give more power?

If Mr. Bruske would compare a four-cylinder and a six-cylinder motor of similar construction and design and *equal piston displacement,* he would find that the four-cylinder motor would give considerably more power than the six.

I hope that you will see fit to comment upon this in your next issue, for I believe that Mr. Bruske's article would tend to mislead many of your readers.—G. N. THURBER, Isotta Fraschini Motors Co.

Uniformity of Performance Should Mean More to Car Designers

NEW YORK CITY.—Editor THE AUTOMOBILE:—The lack of uniformity in the performance of cars of the same make, some of which may run 20,000 miles without any trouble and yet others will break down within the first 500 miles is a subject that should receive more consideration by car designers than it has.

Neglecting the personal factor, the three main causes of varied performance in cars of the same make are: careless workmanship; lack of homogeneity of material; lack of adjustment. It must be admitted that in many cases the trouble a car gives is due entirely to careless handling, and in other instances the poor showing compared with other cars is due to the character of the roads, the speed at which the car is driven, the load carried or the grade of oil used. Yet these facts will not explain why some cars give a great deal poorer service than others.

Careless workmanship is one possible cause of trouble but in these days of interchangeable parts and advanced methods of inspection this should be negligible. Certainly there is no excuse for parts not fitting properly, nor is there any reason why surfaces should not be machined to the required degree of smoothness. There is, however, one point under this head, to which trouble is sometimes due and that is improper hardening. It is not an unusual occurrence for a set of bevel pinions, for instance, to come through without being properly heat treated. The result is that these give out in a very short time. The remedy for this fault is better inspection methods.

Lack of homogeneity of material in similar parts of different cars of the same make accounts in a larger measure for variable performance. For example the babbitt in the engine bearings of one car may be of a finer texture and therefore better able to withstand wear or maybe the cast iron cylinders on one machine contain more carbon than those on another, and are therefore harder and will last longer.

Another point that must not be lost sight of here is the variation of homogeneity in the material in each part. For instance, in the bearings just mentioned the babbitt might have a uniform texture throughout and therefore would wear evenly and last longer than some other bearing that varied in hardness or ability to withstand pressure and wear. The remedy for this is more care in the selection of material and in the making of the raw material.

The last, and probably most important point to consider, is lack of adjustment. This one not only lies at the bottom of a great many of the serious breakdowns that some cars have but also is the cause of the smaller but equally annoying troubles. First let us revert to the engine bearings mentioned in the preceding paragraphs. There are instances where bearings have stood up for 20,000 or more miles without requiring taking up and on the other hand some cars need the bearing attended to within the first 500 miles. While this difference is due to difference in material in some cases it is often ascribable to lack of adjustment. Sometimes bearings are too tight and burn out and again they are too loose and pound themselves to pieces. Their adjustment is largely a matter of guess-work, no two men will adjust alike and the result is a variable performance.

Lack of Adjustment Causes Trouble

Lack of proper adjustment also causes trouble in the various other bearings in the same way but it ought not to be necessary to give more examples along this line. The remedy, it seems to me, would be to devise accurate means of adjusting the different parts so that the required tightness of a bearing, for instance, could be measured as accurately as the diameter of a wristpin, for example. To further illustrate my idea, a feasible method of adjusting cup and cone roller bearings would be to screw up on the inner cone by means of a wrench that would show how great a force was being expended in turning the cone. This wrench could be an ordinary type with the pull applied through a spring balance on the end of the handle, thus the actual pull in pounds would be indicated. The pull necessary to adjust any bearing would be determined beforehand and so by the use of this device it would be possible to adjust the bearing exactly and the element of uncertainty would be entirely eliminated. This would be productive of greater satisfaction than is now the case. —ROBERT F. CHAPMAN.

Some Recent Rulings of the Courts

By George F. Kaiser

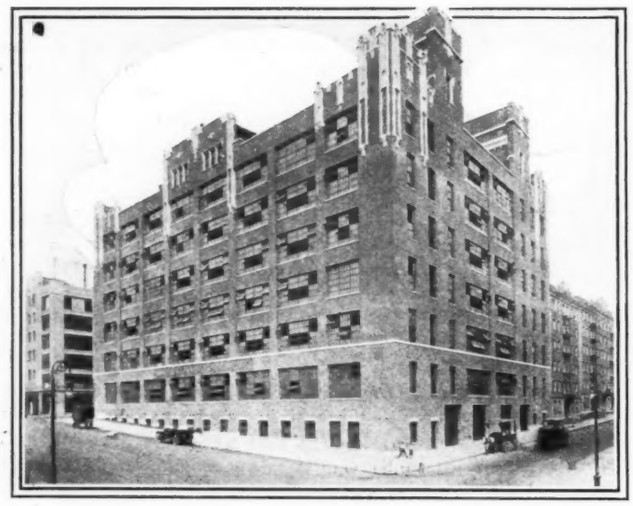
A CAR owner in North Dakota recently sued the manufacturer of a lubricating oil he used to recover damages which he claimed were caused by the defective qualities of the lubricating oil. The testimony in the case showed that the only evidence of defect in the oil was the presence of carbon in the cylinders and crankcase, and as there were no further evidences of wear, the Court decided against the owner claiming that if there were any damages to the owner's car they must necessarily be confined to the condition of the engine at the time he ceased using the alleged defective oil.—Knight vs. Willard, 143 N. W. 346.

No Rent for Sunday Car

The right to recover money for the rent of a car on Sunday was denied in a case decided in Georgia lately because the Georgia penal code contains the provision that a person must not pursue one's ordinary calling on Sunday and the regular business of the man who rented the car was renting cars for hire. The court said that renting a car for a pleasure ride was neither a work of charity nor necessity and the fact that the defendant made a promise to pay on a following weekday did not affect the matter.—Jones vs. Belle Isle, 79 S. E. 357.

Struck by a Trolley Car

In a Texas case where a motor was struck by a trolley while crossing a street its owner sued the trolley company. In the lower court the case was decided in favor of the car driver, but this was reversed in the upper court. The upper court held that the driver was guilty of contributory negligence and the trolley company had the right to have the judge instruct the jury that contributory negligence was a complete defence to the action even though the motorman was also negligent in running the trolley.—Austin Street Railway Co. vs. Heflin, 158 S. W. 1040.



International service station, showing Sixty-fourth street side. Note elevator towers

Equipment Feature of I. M. C. Service Station

International Company's Garage in New York Noted for Its Size and Equipment

ONE of the largest garages and repair stations in the world has recently been erected by the International Motor Co., New York City, to take care of the numerous Mack, Saurer, and Hewitt trucks in and around the metropolis. It is a seven-story concrete and steel structure facing on West End avenue and extending from Sixty-third to Sixty-fourth streets. The exterior presents a pleasing appearance in a finish of buff brick and terra cotta, and is marked by the large window spaces. The building occupies a plot of ground measuring 200 feet on West End avenue and 140 feet on the side streets, giving a total of 200,000 square feet of floor space. The two lower floors have direct entrance from the street, the first floor being on a level with Sixty-fourth street and, due to the slope of West End avenue, there is a level entrance to the basement on the Sixty-third street side.

While this building was built primarily as a service station and garage for International trucks, the El Arco radiator and many of the parts of the Hewitt truck are made here and so an unusually well-equipped machine shop and sheet metal working department is found. In addition, a general public garage and repair business is conducted.

Quick and Efficient Service—A Feature

The most important feature of this new plant is not its size, however, but quick and efficient service, and with this idea in view the station is operated continuously, 24 hours a day, 7 days a week, the men working in three shifts of 9 hours each. The shifts overlap so that the men leaving can instruct those coming on, and thus the work is continued without a hitch.

A point requiring especial emphasis in connection with the delivery of quick and satisfactory service is the personal attention given each car by the general manager and the superintendent. In a plant of this size the personal element is often entirely lacking, the operation of the various departments being so systematized that the troubles and complaints of the owner never get past some irresponsible clerk that has no interest in rendering maximum service. For this reason it has often been said that the small garage with inferior equipment, but in which repairs are personally supervised by the proprieter is capable of furnishing more satisfactory service in the end.

When this plant was put into commission the officers of the International company determined that, in spite of the size, that they would give the patrons all the advantages of personal attention present in smaller establishments.

So the office system was built up with this idea foremost and with the result that all the details of every job are known by both the general manager and the superintendent, and every patron comes in direct contact with them.

Turning now to the interior of the building. In each corner of the building is a stairway running clear to the top. These stairways are separated from the main part of the structure by hallways that are open to the air, so that in case of fire the smoke would find its way to the outside through these passageways and there would be no tendency for it to enter the stairways.

There are two passenger elevators, one at each end of the building and two truck elevators both on the Sixty-third street side. All elevators run clear to the roof, because the forge shop, testing laboratory and drafting room are up there. In addition there are two automatically controlled, electric dumb waiters running up through the center of the building for carrying parts from one floor to another.

The front or Sixty-fourth street side of the basement is given over to the heating plant, fire pumps for running the sprinkler system, and the electrically driven compressor that supplies air throughout the building for cleaning and operating pneumatic tools of all kinds. This compressor automatically maintains the pressure between 75 and 100 pounds. It operates intermittently; when the pressure drops to 75 it starts up and then when 100 is reached it shuts off.

On this floor, also, is located the equipment for recharging electric trucks. Twelve plugs ranged along one wall are provided so that as many trucks can be charged at one time. The rest of the space on this floor is used for storage.

Small Repairs Made on Main Floor

On the main floor are the offices of the general manager and the superintendent and the other men directly connected with the repair work. The rest of this floor is used for making short repairs, and adjustments, those not involving the taking apart of the main units, such as the motor and gearset. Also on this floor is found a room for oxy-acetylene welding. The welding outfit is portable so that whenever possible, the work is done on the main floor, the fractured parts, in some cases, being joined together without removal from the chassis. This floor is divided longitudinally into three sections by two aisles connecting with the entrances at the front of the building. Over each aisle is a traveling hoist of the differential chain pulley type capable of lifting 4 tons. This hoist is not only used for bodies and motors, but is employed for such jobs as holding up a car when an axle is to be removed. No wash racks are provided, but the aisles have a slope of 1 in 100 so that a truck can be washed anywhere along their length.

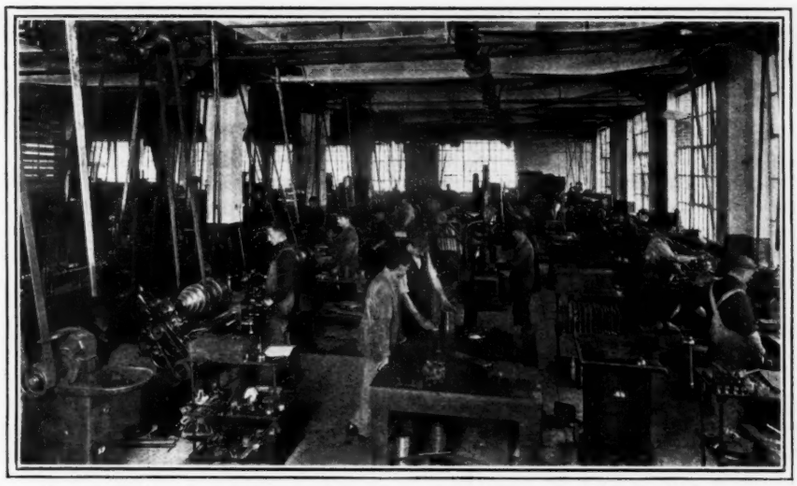
An interesting tool used in connection with the repair work on this floor is a portable drill press, consisting of a small radial drill mounted on a vise stand. The drill is directly driven by a small motor, while the work is held in the vise attached to the stand. The vise stand is fitted with casters and embodies a table-like top mounted on a sheet steel cylinder about the size of an ash can.

A hydraulic system of gasoline storage is used and there are two outlets on each of the three lower floors so that the filling of the cars is a simple and easy matter.

Six service trucks are kept on hand to start out on a moment's notice. These trucks are for rendering any service they can, from towing in a machine to delivering the load of a disabled truck. The point to be emphasized in connection with this feature of the equipment is the dispatch with which a call for help is answered.

The general offices are located on the front of the second floor, the rest of this floor being given over to storage, while on the next floor the new Mack, Saurer and Hewitt trucks are kept and here also is found the second hand department.

The machine shop and stock room are located on the fourth floor, these departments occupying about an equal space. The machine shop is noteworthy because of the great number and variety of the tool equipment. As already mentioned, quite a number of the parts for the Hewitt truck are made here and so in addition to the tools ordinarily in a repair shop we find several grinders for cylinders, camshafts, crankshafts and other parts, full and semi-automatic turret lathes, a couple of Fellows gear shapers and a Gleason bevel gear generator. Such an equipment is of special advantage in New York because of the many foreign cars in the city. Parts for a great many of these cars cannot be obtained in this country and therefore there is a great demand for a shop capable of turning them out.



View of one corner of the machine shop. Note vise stand in lower right corner

Adjacent to the machine shop is the stock room which is divided into three sections, one for each of the trucks made by the International company. An interesting feature in connection with this department is a collection of motor truck parts that are rented out to owners at a nominal figure to replace parts that are undergoing repair. These parts include wheels, radiators, lamps and magnetos. This scheme often results in a great saving to the owner because it enables a truck to be kept in service when otherwise it might be necessary to lay it up for several days.

Maximum Service—Company's Policy

This plan is in line with the company's service policy, to give a maximum of service, to keep the trucks on the road as much as possible and in the shop only when absolutely necessary. And the company believes in charging the owner just what it cost to render this service. Its idea of service is not to give something for nothing, the popular interpretation, but to give quick and adequate service just when needed and charge for it.

On the Sixty-third street side of the stock room and between the big elevators is the receiving and shipping room, and in connection with this department of the plant there is one point worthy of mention, and that is, the method of keeping track of the stock. A perpetual inventory is maintained by the use of loose-leaf ledgers, a separate page being employed for each article carried. Thus the amount of stock on hand can always be ascertained by referring to these ledgers, because both the receipts and disbursements of each article are entered, and the difference gives the amount on hand. The minimum number to be carried in stock is also on the leaf and so when this number is reached more parts are ordered. This system of keeping stock is not new but nevertheless is worth describing in detail because it shows the satisfactory application of a very simple system to a very large and varied line of stock.

Second floor, showing arrangement of trucks. Note elevator at rear

The sixth floor is devoted to body work, in all its phases and so we find a complete woodworking shop, an upholstery department and paint shop. The equipment includes several circular saws, planers, band saws and special tools for making wheels. The upholstery department is not only capable of making all sorts of repairs but has the necessary sewing machines, etc., for fitting out a complete body.

Rough painting is done on the main part of this floor while the finishing coats are applied in a dust proof room located between the freight elevators. This room is partitioned off by canvas curtains and it is kept at a temperature considerably higher than the rest of the building in order to facilitate the drying of the varnish.

Forge Shop on Roof

An interesting feature in the design of this building is the use of the roof as a yard, on to which opens the forge shop, testing laboratory, drafting room, and elevators. The forge shop is located in the center of the roof area and is almost as long as the building is wide while its width is about 40 feet. It is most accurately described as a shed because the side facing the freight elevators is lined with sliding doors. The space between the shop and the elevators is used for washing the trucks and in this sense is a yard. Interesting to note, here, is the use of the steam ejector principle in washing. The steam and water lines are connected together so that the steam not only warms the water, but increases its velocity with the result that the impact of the stream from the hose loosens the dirt while the heat of the water materially aids in dissolving grease.

The forge shop contains a variety of equipment and is capable of turning out all kinds of work where the employment of heat is required. One end contains the tools and the other is used for running in complete truck chassis for repair. Two open forges are fitted and in addition there is a power hammer, a power press, a power hacksaw and a drill press. Here, also, is found a complete heat treating outfit, consisting of a large gas oven, with an electric pyrometer for measuring temperatures, and oil, lead and water baths for hardening and tempering. This equipment is valuable in two ways: in the first place it enables all sorts of special parts requiring hardening, such as gears, push-rods and the like, to be turned out, and secondly it allows repairs to be made in some cases where, were it not for this

equipment, replacements would be necessary. The forge shop is so located that the automatic dumbwaiters for carrying parts run up into it.

Now that a general idea of the layout of the building has been obtained we will follow the path of a truck through the various departments. The truck on being brought in is thoroughly inspected under the supervision of the general manager or the superintendent and its troubles diagnosed. If little work is required to put it back into condition, it remains on the first floor, but if the repairs involve the tearing apart and replacement of parts, the truck is sent up-stairs.

When a complete overhauling job is done the truck is first taken to the roof, where it is washed, and then if any blacksmithing work is required on it it is run into the forge shop. At the same time if any body work is to be done, the body is removed and taken down to the floor where this is done. The truck chassis is then taken to the machine shop where it is overhauled. Finally the chassis is sent up to the paint shop where the running gear is painted and the body put on, and then the truck is ready for delivery.

Filing System Protects Customer

Of special interest is the filing system employed for keeping track of the time and material used on each job, and here two features stand out: the giving of the owner a complete and detailed account of the whole job, and an accurate system of time keeping so that there is no danger of the customer being charged for more time than was spent on his truck. The system by which this is accomplished, is very simple and complete and so merits description.

When a truck is brought in, an order card, at the right, Fig. 1, is made out in quadruplicate. Besides the customer's name and address, the chassis make, number and size are put down, and also the name of the man giving the order and the way it was received, whether by telegraph, telephone or by word of mouth, are noted. Below these items is a list of the principal car parts which are marked with the letters A, X, O, or I depending on whether these parts are to be repaired, adjusted, disassembled or left untouched. With the use of such a card there is very little chance for a mistake to occur because all the items not to be repaired are checked with an I. On this card, there is also a space for rentals and remarks. Under the latter any parts to be repaired, not listed above, would be made note of. The original of this ticket together with one carbon copy is sent to the owner, the original to be kept by him for reference, while the copy is signed by him and returned as an authorization for the work and no work is begun until this copy is returned. In this way a great many disputes that might otherwise occur are avoided.

Repair Tag Attached to Truck

Another carbon copy is kept in the office as a ready reference and as a record in case the others should be lost. The fourth copy is attached to the truck and for this reason it is made out of heavy cardboard. The directions on this copy are carefully followed by the workman so there is no chance for a mistake in the repair work to be made.

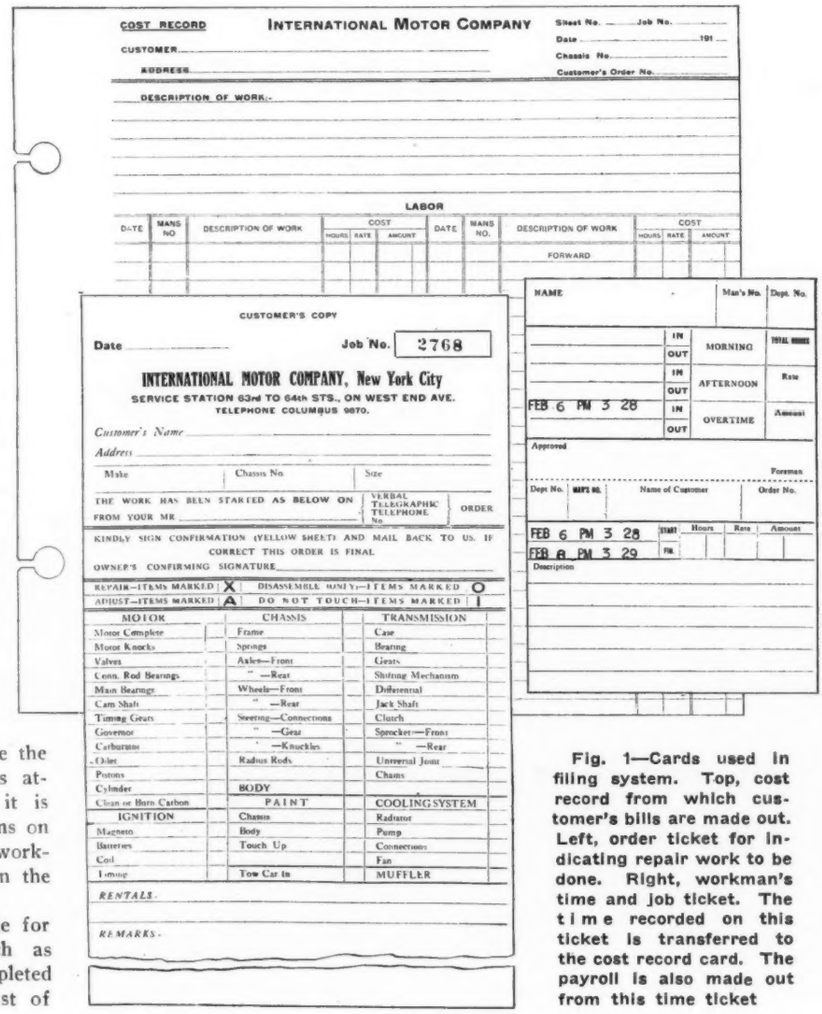
On the back of this tag provision is made for listing the equipment on the truck, such as lamps, tools, etc. When the job is completed the owner or his agent checks over the list of repairs and if the job has been finished to suit him he signs this card and then the truck is delivered to him.

The next step in this system is to describe the method of time keeping. A workman's time ticket is seen at the right, Fig. 1. The top of this ticket is used in figuring the total time each man puts in daily and is used in making up the pay roll. Attached to this are a number of job tickets, only one shown, on which are recorded the time of starting and finishing each job. The total time as indicated by these job tickets must be approximately equal to the number of hours put in by the workman and thus there is no danger of a customer being overcharged as might happen if the workman estimate the time.

The clocks for punching the time are electricaly controlled. On each floor there is a master clock that is used only for punching the workman's time ticket at the beginning and end of each day. This clock registers to the minute. The time of starting and stopping each piece of work is stamped on the job tickets by smaller clocks controlled by the master clock, and there are enough of these on each floor so that a workman can always find one handy. These clocks only register to tenths of an hour.

On each job ticket the department number, man's number, the name of the customer and the order number are put down, but in addition the workman is required to give a complete story of just how he spent his time, thus saving many disputes between customer and company because quite often the amount of time expended in doing a certain job is not apparent on the surface. For instance if a bill for 3 hours time were put in for attaching

(*Continued on page 468.*)



COST RECORD — INTERNATIONAL MOTOR COMPANY

Sheet No. ____ Job No. ____
Date ____ 191 ____
Chassis No. ____
Customer's Order No. ____

CUSTOMER ____
ADDRESS ____

DESCRIPTION OF WORK ____

LABOR

DATE	MANS NO	DESCRIPTION OF WORK	COST HOURS	COST RATE	COST AMOUNT	DATE	MANS NO.	DESCRIPTION OF WORK	COST HOURS	COST RATE	COST AMOUNT
		FORWARD									

CUSTOMER'S COPY

Date ____ Job No. 2768

INTERNATIONAL MOTOR COMPANY, New York City
SERVICE STATION 63rd TO 64th STS., ON WEST END AVE.
TELEPHONE COLUMBUS 9870.

Customer's Name ____
Address ____

Make	Chassis No.	Size

THE WORK HAS BEEN STARTED AS BELOW ON FROM YOUR MR ____ VERBAL TELEGRAPHIC TELEPHONE No. ____ ORDER

KINDLY SIGN CONFIRMATION (YELLOW SHEET) AND MAIL BACK TO US. IF CORRECT THIS ORDER IS FINAL

OWNER'S CONFIRMING SIGNATURE ____

REPAIR—ITEMS MARKED X | DISASSEMBLE ONLY—ITEMS MARKED O
ADJUST—ITEMS MARKED A | DO NOT TOUCH—ITEMS MARKED I

MOTOR	CHASSIS	TRANSMISSION
Motor Complete	Frame	Case
Motor Knocks	Springs	Bearing
Valves	Axles—Front	Gears
Conn. Rod Bearings	" —Rear	Shifting Mechanism
Main Bearings	Wheels—Front	Differential
Cam Shaft	" —Rear	Jack Shaft
Timing Gears	Steering—Connections	Clutch
Governor	" —Gear	Sprocket—Front
Carburetor	" —Knuckles	" —Rear
Oiler	Radius Rods	Universal Joint
Pistons		Chains
Cylinder	BODY	
Clean or Burn Carbon	PAINT	COOLING SYSTEM
IGNITION	Chassis	Radiator
Magneto	Body	Pump
Batteries	Touch Up	Connections
Coil		Fan
Timing	Tow Car In	MUFFLER

RENTALS ____

REMARKS ____

NAME ____ Man's No. ____ Dept. No. ____

	IN	MORNING	TOTAL HOURS
	OUT		
	IN	AFTERNOON	Rate
	OUT		
FEB 6 PM 3 28	IN	OVERTIME	Amount
	OUT		

Approved ____ Foreman

Dept. No.	WORK NO.	Name of Customer	Order No.

	START	Hours	Rate	Amount
FEB 6 PM 3 28				
FEB 6 PM 3 29	FIN.			

Description ____

Fig. 1—Cards used in filing system. Top, cost record from which customer's bills are made out. Left, order ticket for indicating repair work to be done. Right, workman's time and job ticket. The time recorded on this ticket is transferred to the cost record card. The payroll is also made out from this time ticket

An Improvement in Power Plants

Efficiency and General Neatness of Appearance Factors in That Department of Big Motor Factory

THE power plant shown in the accompanying illustration supplies the power, light and heat for the Continental Motor Mfg. Co., Detroit, Mich. It takes care of the power wants of 1,500 men scattered through a factory space of 300,000 square feet floor area and helps them in their work of turning out from 20,000 to 30,000 motors a year.

An independent building is used for the power plant. Its site was selected with a view to rendering the power house accessible in order that coal can be readily conveyed to it on a special track, and at the same time having a central location in relation to the entire factory. The future growth of the power house has been allowed for by having plenty of vacant space surrounding it.

In laying out the power plant the builders took care to provide plenty of space around the power units.

Building Is Fireproof

The material used in the building is fireproof. Structural steel girders and beams form the frame work of the edifice and the exterior is composed of pressed brick for the walls and cut stone for the trimmings. In order to carry out the fireproof idea to the utmost extent steel sash is also used in the building.

Anyone desiring to enter the power house from the main factory need not pass outside the doors of the establishment, as there is a tunnel having a height of 9 feet and a width of 8 feet connecting them. This tunnel not only takes care of human traffic between the two buildings, but also provides passageway for the piping and electric wiring. All the electric wires are confined in a steel conduit and placed on one wall, while the piping is carried on the other.

Mechanical Stokers Used

The room in which the steam is generated is equipped with three of the latest types of Wick's vertical-tube boilers. These three boilers combined have a heating surface of 7,500 feet and are adapted to a working pressure of 150 pounds steam pressure. This is the same pressure that is used in conveying a moderate-size ocean liner across the seas with its powerful triple-expansion engines. Instead of the swarthy, panting men plying shovel and wheelbarrow deep down in the stokehold, the boiler room bears a clean appearance, due to the use of Murphy mechanical stokers, which take the coal from tanks above the boilers and feed it to the flames beneath the boilers. The coal is conveyed to the bunkers by means of an electrical monorail coal carrier which runs out into the yard on a trestle and after picking the coal from the freight car, carries it to the plant, where it is either deposited in the storage bins or into the metal bins above the boilers from which it is fed by the mechanical stokers.

In order to take care of a boiler plant of this capacity large volumes of water must be moved. To do this, auxiliary machinery in the way of pumps is required. In the Continental plant the boilers are supplied by Duplex plunger pumps made by the Deane Steam Pump Co. The boilers are connected to a reinforced concrete stack with a tile facing having a flue 8.5 feet in diameter and 150 feet in height.

Four Units Compose Plant

Two principal direct-connected units and two auxiliary direct-connected units compose the power outfit. The type and capacities of these units are as follows:

Unit No. 1 consists of a three-phase, sixty-cycle, 220-volt generator rated at 500 k.v.a. direct-connected to Hamilton Corliss compound engine having one 20 and one 30 by 36-inch cylinder, running at 120 revolutions per minute.

Unit No. 2 is an Erie Ball, four-valve, Cross compound engine, 19 and 30 by 27 inches, running at 150 revolutions per minute and direct-connected to a 400 k.v.a. Westinghouse three-phase, sixty-cycle, 220-volt alternating current generator.

Electric excitation is furnished by a small 25-kilowatt, 110-volt generator running at 3,500 revolutions per minute and direct-connected to a Westinghouse steam turbine and 40-kilowatt motor-generator set running at 830 revolutions per minute. There is also an air compressor, 300 cubic feet capacity, single stage, manufactured by the National Brake and Electric Co. This is also direct-connected to the Westinghouse motor.

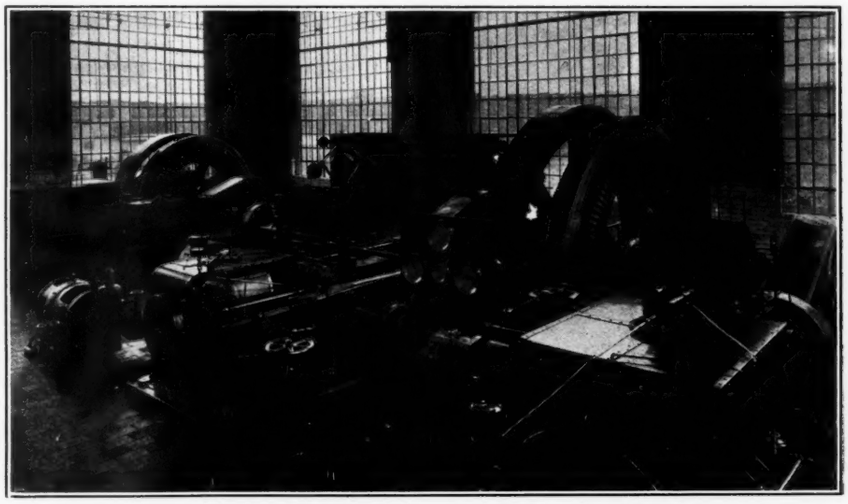
Appearance Is Neat Throughout

The idea of making the power plant as prepossessing as possible is carried out in the various fittings. The switchboard is an instance of this. It is made up of six panels of gray Tennessee marble having all the trimmings with a black oxidized finish. This board contains all the necessary instruments, including frequency meters, power factor meters, synchroscope, alternating and direct current volt meters, indicating and recording watt meters which tell the output at any time or covering any period and everything possible to make a complete instrument and control board.

Emergency Provision Made

In order to be able to cut out any of the electrical devices in case of emergency where it is necessary to immediately interrupt the current, regardless of its strength, an ITE circuit breaker is fitted to each instrument. For moving heavy parts around the plant the entire power room is spanned by a 15-ton Shaw crane.

In short, the entire installation may be said to be one of the most compact, simple and yet one of the most powerful equipments of its size in use.



The power plant of the Continental Motor Mfg. Co., Detroit, Mich., is not only a very powerful installation, but also has the virtue of an attractive appearance, the switchboard, with its marble panels and oxidized instruments, being an important feature

The Rostrum

More Discussion on High-Speed Motor

EDITOR of THE AUTOMOBILE:—In reference to the article by Mr. C. G. Hinkley in your number of Feb. 5th, I would say that I cannot agree with Mr. Hinkley's views on slow and high-speed engines.

His idea that high-speed engine design should be connected with a Ford engine in a 2,800-pound car is incorrect. Consider the matter as follows: Given, for instance, a 4-inch bore by 6-inch stroke engine of normal construction in an ordinary car weighing about 3,000 pounds. The engine will develop its maximum power at about 1,800 revolutions per minute, and suppose the car at this engine speed made 40 miles per hour. Now if by the use of larger valves and piping, etc., we could, without material increase in the weight, increase the engine speed to 2,700 revolutions per minute, we would then have a car capable of 60 miles per hour, whose engine at ordinary car speeds would not be turning over any faster than the slower car with the choked engine.

Mr. Delling really brought out this point in his excellent article in your number of October 16. Mr. Pomeroy in a recent article showed that extreme valve timing which would tend to reduce the torque at slow speeds is not necessary if large valves are used, but the valves must be large in diameter and have a good lift also. Either one, without the other, will not give the desired results. Of course an extreme valve timing on a large valve engine will give even greater power, but exceptionally good results can be obtained without it.

Referring again to Mr. Delling's article, I would like to say that his statement that additional horse-power is obtained by increasing the piston speed is misleading, as it is really an increase in revolutions per minute, which increases the power. For instance, in his engine, which is about 4-inch bore by 6-inch stroke, we could have increased the piston speed at 1000 revolutions per minute, for instance, by changing to a bore of 3⅝ and a stroke of 7¼, which would give the same piston displacement as a 4 x 6 cylinder, but we would not have increased the power of the engine. But by increasing the number of revolutions per minute from 1,000 to 2,000 we pass twice the number of cubic inches of gas through the engine in a given time, and if the mean effective pressure can be kept nearly the same there will be a proportionate increase in power.

I cannot agree with Mr. Delling's statement that the size of the exhaust valve is not so important because the piston shoves the exhaust gas out on the exhaust stroke. I think it has been well proven that the gas must be fairly near atmospheric pressure before the piston starts up on the exhaust stroke or the back pressure will cause a big loss of power. This means that a great deal of gas must be gotten rid of in a very short period of time, which necessitates a large exhaust valve. The very design of the Deltal engine constructed by Mr. Delling, which has very large exhaust valves opening 68° before lower dead center, would seem to prove this to be the case.

EDWARD G. INGRAM.

New York City.

States Advantages of Valve-in-Head Motor

Editor THE AUTOMOBILE:—The speed records and the tremendous power of the 300 horsepower Fiat in France, several weeks ago, the gasoline economy records of the Franklin in 1913, the surprising efficiency of the Buick, Cunningham and Franklin, all the motors of which have overhead valves, has again brought up the question as to the superiority of this construction. So far, the only reasonable objections to valve-in-head motors have been the excessive noise after short usage and a slight increase in the cost of construction. As to the advantages gained by the use of the valve-in-head motor it is said that per given displacement it is more powerful because its construction permits of the formation of a combusting chamber whose wall surface is smaller in proportion to its volume than that of either T or L-head motors. This decrease in wall area reduces the surface through which heat is lost and thus increases the thermal efficiency of the motor. The valve-in-head motor, due to the spherical combustion chamber which is obtained by such construction, creates improved scavening of the exhaust gases and consequently improves gasoline economy.

So far the nucleus of these objections has been the noisy, expensive and complex operation caused by the use of pushrods or rockers. Overhead camshafts have been used to a certain extent on high-powered racing motors, such as are the Isotta-Fraschini, Fiat, Peugeot, etc., and their extreme and almost unlimited power and speed have caused great satisfaction and most excellent results, both on the track and in speed trials, but on these cars the principle of eliminating noise and building expenditure has been omitted. Before the adoption of the Weidley motor by the Premier Motors Co., there was no car on the market having overhead valves and camshaft which did not employ

rocker arms in valve operation and which combined together the advantages of being flexible, silent and powerful with extreme efficiency and low cost of fuel upkeep. Its silence has been obtained by the placing of both intake and exhaust valves directly over the cylinder, their motion being imparted to them by means of a camshaft driven by a vertical shaft.

The purpose of this slight exposition is to demonstrate to the general motoring public that the idea that the valve-in-head motor is out of style, inefficient, noisy, etc., is entirely false and that when it is constructed and designed correctly is noiseless, economical, powerful and very efficient.

Wilmette, Ill. ROBERT B. WHITE.

Center of Gravity Unchanged by Underslinging

Editor THE AUTOMOBILE:—On December 11 you published a letter of mine concerning the effect of underslung frames on the center of gravity of the car, and as there seems to be quite some interest in this subject I believe that a further discussion of this matter, with illustrations to bring out the points of construction, are of value. In Fig. 1 are illustrated four chassis, two have 32-inch wheels and two 42-inch wheels and one of each is underslung and the other overslung; also it will be noted that the clearance on all four is 10 inches, this distance being measured from the flywheel housing, which is the lowest part of the chassis in this case to the ground. A study of these four diagrams will show that the center of gravity is not affected by the position of the frame with reference to the axles. The two upper figures represent one extreme, these two chassis being equipped with 32-inch wheels and the two lower, the other extreme, having 42-inch wheels. Now referring to those with 32-inch wheels it will be noted that the center of gravity of the two is the same except for the change in mass center caused by the different position of the frame itself, and this is negligible. The clearances under both cars is exactly the same and the power plants have the same dimensions. In other words, the disposition of the masses in the two designs is practically the same, and therefore the popular idea that underslung cars have a lower center of gravity is erroneous.

Now looking at the two chassis with 42-inch wheels it is seen that the conditions are exactly the same, except that with the overslung construction a large kick-up in the frame is required at the rear in order that the body will properly clear the axle, and therefore it may be said, that this is the only advantage in using the underslung construction on a car of any size.

Now that I have shown that as far as the chassis is concerned, the frame suspension has nothing to do with the center of gravity, the only question that remains is whether the body on an overslung car can be set as low as on the underslung type. Referring again to the figure it will be seen that the controlling factor in body location is the position of the top of the gearbox, because it is hardly possible to place the floor below this point. Thus it is seen that the height of the floor from the ground is the same whether the car is over or underslung, and with the location of the floor determined, the height of the rest of the body is automatically fixed. In other words, a body can be set just as low on an overslung chassis as on an underslung type.

New York City. H. F. B.

Believes in Under-Inflated Tires

Editor THE AUTOMOBILE:—The experience of Mr. Snow with under-inflated tires is exactly the same as mine, only I use even less pressure than he does.

My car weighs exactly 2000 pounds and is equipped with 32 by 3.5-inch tires. I have run the same car 8 years. The engine is 3.75 bore by 4.25 stroke, four-cylinders and is geared 3.74 to 1 on high gear.

The first 5 years I had no pressure gauge, but then I bought one and found I had been carrying less than 30 pounds per square inch and I then adopted the practice of pumping them to 35 pounds. During the entire 8 years I have had only two tires that ran less than 5000 miles; all the rest have run from 5100 to 9600 miles. I have had no blowouts excepting three old shoes that had been in use a long time, and one of the two that run less than 5000 miles, which tire I thought had a defect in the fabric.

My records show that my greatest mileage was reached during the time I had no pressure gauge, and was using less pressure than during the last three years. On one occasion last season I pumped all tires to 55 pounds just to see how much difference it made with the riding qualities of the car. The result was surprising; the vibration was enormously increased, and every little stone run over could be easily felt. After running 10 miles I let the pressure down to 35 pounds and the car then felt as usual.

The speed I drive rarely exceeds 25 miles per hour at any time and this speed is never maintained for any length of time.

My average touring speed is not over 16 miles per hour, that is, 80 miles for 5 hours' run over roads that are practically all dirt or gravel.

My car is a runabout weighing 2000 pounds. The size of the tires are 32 by 3.5, air pressure 35 pounds maximum, average mileage per tire on the last nine tires I have used is 6056 miles. Possibly I might have gotten more mileage with higher pressure, but I like to have them soft enough so they will absorb small shocks.

Brattleboro, Vt. CHAS. A. SMITH.

Tandem Cyclecars Are Superior

Editor THE AUTOMOBILE:—H.M.F. has somewhat misunderstood the cyclecar outline of my former article to judge from his letter published in your issue of February 5. He states that

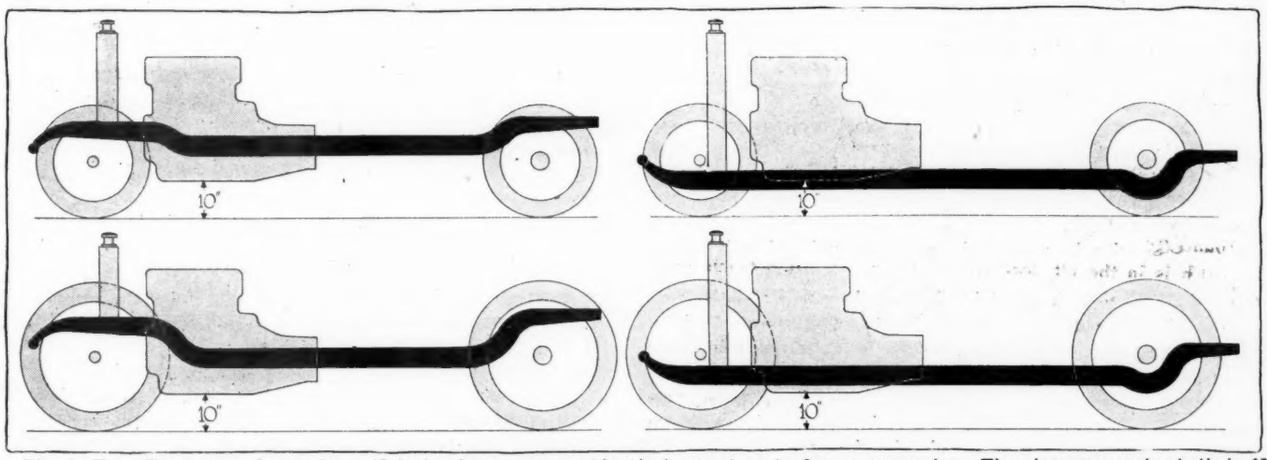


Fig. 1—Top—These two chassis have 32-inch wheels and are identical except as to frame suspension. The clearance under both is 10 inches and the power plants are alike. Bottom—These two chassis have 42-inch wheels, and power plants and clearances are the same as in the other two chassis. Note that the center of gravity of both is the same

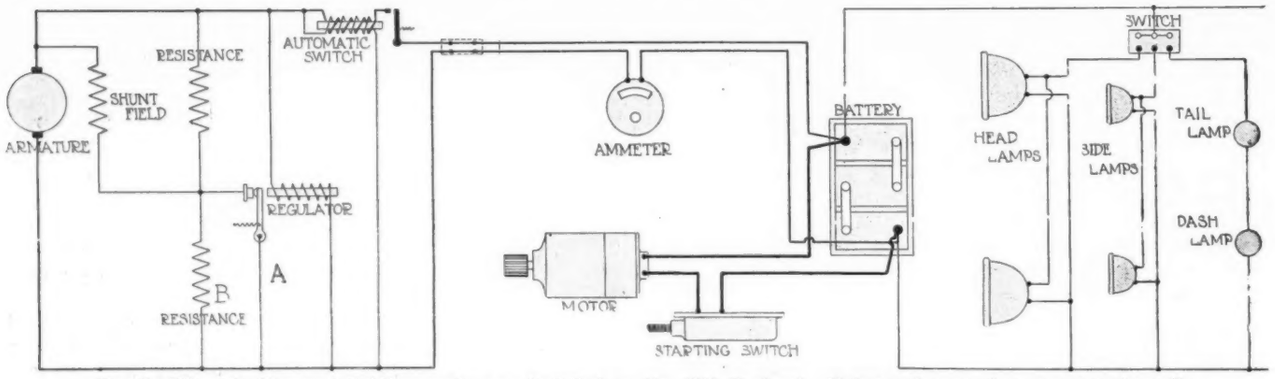


Fig. 2—Bijur starting and lighting system as installed on the 1914 Packard. Motor and generator are separate units

it was written from the manufacturer's standpoint alone and ignoring public prejudice. I think this was answered in my S. A. E. paper recently published in THE AUTOMOBILE, where cost was put as the basis of the cyclecar movement. Give the public what it demands and it will want a small motor car in every particular, a thing not only too expensive, but which would not do the work as well as the simpler types. The public thinks it wants side-by-side seating but will change its mind very quickly after the first few rides in and sights of these cars.

I would ask H.M.F. merely to reserve judgment on tandem seating until such time as he has taken a rough road in one at speed and has really seen the remarkable comfort.

The staggered seating also is excellent if on 36-inch tread but beyond a 40-inch tread so much power is required that all cars so constructed will either drop to 36-inch or go up to 56 and a water-cooled motor of over 71 inches thus taking them out of the cyclecar class.

As to belt drive it is an excellent step, but not the eventual drive. It has already proved that with 36-inch tread a differential is useless and unnecessary and hence single chain drive instead of double, which he mentions, will probably be used. Wider cars will use two chains. If four-cylinder motors are used they will not be air-cooled and then magnetos will be used. With the V-types the battery systems are much better.

As to all critics of the cyclecar I would but ask that they reserve judgment until they have ridden in the cars and have learned the remarkable things the little vehicles do that are impossible to other types.

Chicago, Ill. WM. B. STOUT.

How to Wire Dual Magneto

Editor THE AUTOMOBILE:—1—Please give a drawing how batteries could be attached to a 1914 Bosch magneto similar to the 1914 Chalmers, for starting purposes.

2—Give a drawing of the starting and lighting system used on the 1914 Packard 38.

3—Who was the first automobile manufacturer to equip his cars with an electric starter?

4—Who was the first to put out fore doors?

5—What was the first company to equip their cars with compressed air starter?

6—Is the Saxon light car controlled by the Chalmers Motor Car Co.?

Washington, D. C. G. E. S.

—1—Ordinarily the 1914 Chalmers is not equipped with a magneto, but when one is specified a Bosch, similar to that illustrated in Fig. 3, is fitted. This is a dual system and the connections for the battery are clearly shown. One terminal of the battery is grounded on the frame and the wire A leading from the other terminal runs to a binding post on the dash coil. Wire B is connected as indicated, running from a terminal on the magneto to the dash coil. This wire is known as the magneto grounding wire because it short circuits the armature when the switch is in the off position. C and D are high tension wires, C making connection between the secondary coil of the magneto and the switch, and D completing the circuit between the switch and the distributor. Wire E, is called the battery circuit breaker, and runs from the coil to a binding post on the magneto. The switch is grounded to the frame through wire F.

2—The self-starting and lighting system, Fig. 2, used on the Packard is manufactured by the Bijur Motor Lighting Co., Hoboken, N. J. In this system the starting motor and generator are separate units.

The starting circuit is simple, consisting of a motor connected directly to the battery and operated by closing a starting switch.

In the generator circuit the principal parts are: The generator; an automatic switch for breaking the circuit when the speed of the generator becomes so low that the battery current would discharge through it, and a voltage regulator of the vibrator type. A study of the wiring diagram shows that the automatic switch has two coils, a voltage coil of high resistance connected across the wires leading to the battery and a current coil in series with the generator and battery. The action of this coil is such that as the armature speed increases and the voltage becomes greater, the magnetism generated in this coil attracts a small steel arm thus completing circuit between the battery and the generator. Current then flows to the battery and lights.

On the other hand, as the speed of the generator decreases its voltage becomes less and finally a point is reached where the current begins to flow back into the generator. This reversal of flow produces a magnetic field in the series coil of the cutout, which opposes the field produced by the voltage coil, until finally the attraction of the latter for the steel arm that completes the circuit is entirely overcome and then the arm, impelled by a spring, breaks contact.

The voltage regulator operates on the vibrator principle, and is designed so that when the voltage becomes higher than the predetermined value the vibrator throws a resistance into circuit that reduces the amount of current flowing through the field. This reduces the voltage. When the voltage becomes too low, the vibrator flies back again and allows full current to pass through the field once more. The movement of this vibrator is extremely rapid, making about 150 oscillations per second, so that in actual practice, no change in voltage, in one direction or the other, is noticeable.

Now looking at the diagram, it is seen that this regulator consists of a vibrating arm which is actuated by an electro magnet connected across the mains running from the generator. When this arm is not attracted by the magnet, full field current is allowed to flow through wire A from one generator lead up through the shunt field to the other lead of the generator, thus full field strength is obtained and a rising voltage is generated, which finally causes the magnet coil to pull this arm out of contact thus breaking the circuit. When this occurs, the current must flow to the field through the resistance B and this resistance reduces the flow of the current and weakens the field so that the generated voltage drops. This reduction in voltage causes a smaller current to flow through the magnet winding and then the attraction of the magnet weakens allowing the arm to fly back, thus enabling full current to flow through the field

again. This cycle is repeated 150 times a second. Special provision has been made so that the contact points on the regulator will not burn away.

3—The Cadillac was the first car to be fitted with an electric starter.

4—It is difficult to say who was the first to use fore-doors, because this feature was brought out by several different European body makers at about the same time. The first application of this design was to torpedo bodies of the extreme type; these were distinguished by long cowls, flush sides and rounded rears. Almost simultaneously with the torpedo, the Berline, or fore-door limousine made its appearance.

Horsepower Curve of Abbott Six

Editor THE AUTOMOBILE:—1—Will you kindly publish in your columns, the weight of the Buick six and the Abbott-Detroit six?

2—Will you print a plot of the horsepower curve of the motors of the above mentioned cars and also give cylinder dimensions?

Lincoln, Nebr. C. J. F.

—1—The weight of the Buick 6 is 3,600 pounds, while the weight of the Abbott 6 is 3,820 pounds.

2—The horsepower curve of the Abbott 6 is given in Fig. 4 while a similar curve for the Buick 6 is not available. The cylinder dimensions of the Abbott are 3.75 by 5.25, while the dimensions of the Buick are 3.75 by 5.

A New Method of Gear Shifting

Editor THE AUTOMOBILE:—I would like to suggest an improvement over H. F. B's. method of noiseless gear-shifting. The clutch of any car gets enough wear in city driving without needlessly slipping it, as he advises, to make it easier to come into second from high speed. My own method of bringing the two gears into approximate rotative speed is simpler than the one outlined in his letter appearing in your issue of the 29th, and more practical. When wishing to drop from high speed into second I take the weight off the engine by easing up on the accelerator for a second, and when the engine has ceased to drive the shaft and before the momentum of the car has begun to drive the engine, I slip my gear into neutral without depressing the clutch pedal. This is done without noise or any wear at all on the dogs on the direct-drive clutch. Then, with the clutch still in, I accelerate the motor and when the counter shaft in the gearset is turning at, what experience has taught me, is the proper speed, I throw out the clutch and slide into second with no noise and no strain on the gears. This operation is a little involved in the telling, but in practice it has become second nature with me, and requires no more than a second for the whole proceeding. I heartily indorse H. F. B.'s assertion that the speed of the motor can be accurately gauged.

It seems to me that a discussion of the methods of gearshifting is of importance because there are so many drivers that do not know how to shift gears properly.

Brooklyn, N. Y. A. F. L.

Batteries Discharged by Short Circuit

Editor THE AUTOMOBILE:—1—I have a 1913 model Overland with U. S. L. starting and lighting system. The starter has given me trouble from the first; the trouble seems to be in the battery, for after using the battery 35 to 40 times for starting and some for lighting, it will go dead. I have had three batteries, and now the third has gone dead. The battery gets discolored at the bottom, the acid has eaten through the box, and something forms on the top. My idea is, that one or two cells are shorted.

2—Can you change a 16-inch steering wheel to an 18 inch? My steering gear seems to almost lock.

Bonneville, Miss. Jos W. SANDERS.

—1—Your battery trouble is due either to a short-circuit some place in the system or else to too low a charging rate.

There are many places that you may have a short-circuit but the probabilities are that it is in the battery itself. If this is the case the plates have been buckled by using too high a charging rate. The effect of using too high a rate is to heat the plates so that they bend over until they come in contact with one another.

Another short-circuiting trouble that may be causing the batteries to give out so soon is due to filling them too full. The cell should be filled 5-8 of an inch above the top of the plate. There is a lead strip above the top of each plate and many owners mistake this for the top of the plate. When the battery is filled up to this point, the liquid soon overflows and runs down the sides of the jar thus causing a short circuit, which results in the battery becoming discharged after being used a few times.

There is a slight possibility that you have a short-circuit in the wiring or in the generator itself and therefore all wiring insulation should be carefully inspected.

If the regulator is set to give too low a charging rate, the result will be that the battery will never become fully recharged and therefore it will go dead in a short while.

The correct charging rate is about 20 amperes when the motor is running somewhere near its maximum speed, and this can be regulated by an adjusting screw located on the dash.

2—You can obtain an 18-inch steering wheel to fit your car from almost any supply dealer, but this will make very little difference in the ease with which the steering is accomplished. The leverage will be increased according to the ratio of the diameters of the two wheels or about 7 per cent.

Fitting a larger wheel because the gear works hard is not to be recommended, however. Something is wrong with it and the trouble should be located without delay because in its present condition it is liable to stick when rounding a curve and cause a serious accident. Inspect the adjustment for taking up the play. It may be that the gear is adjusted too tightly. Then again it may need lubrication or a ball-bearing may be broken, causing it to jam.

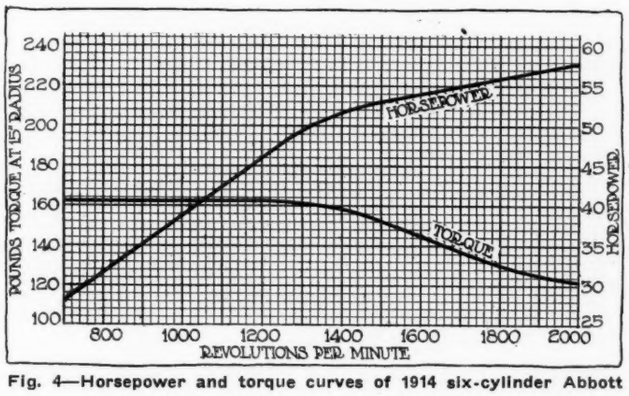


Fig. 4—Horsepower and torque curves of 1914 six-cylinder Abbott

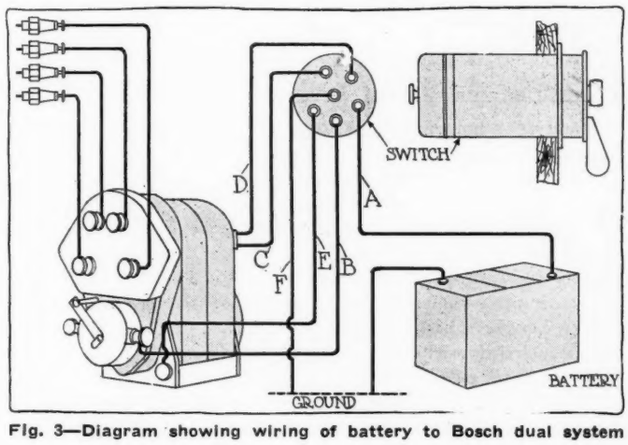


Fig. 3—Diagram showing wiring of battery to Bosch dual system

The Engineering Digest

Interesting Figures of German Exports with Sidelights on Large Features of Construction and Market Conditions

MOST MARKETS SLOW FOR LUXURIES SINCE JULY

AS results of engineering are in the end measured commercially, some details from the German export business in automobiles for 1913 and a comparison with the corresponding figures for 1912 may be taken as involving points of considerable technical interest, especially to those acquainted with the trend in German construction as well as the conditions of the world markets. The official figures for 1913 have just been published and the two dominating facts established by these statistics are, first, that the increase in the total of exports over the preceding year comes under the head of trucks and delivery wagons and, secondly, that Russia is developing into a very important market for automobiles as well as for commercial vehicles, the gains in the automobile trade with that country being offset for Germany, however, by losses in other markets, especially those of South America.

The increase in German exports of motor vehicles, including motorcycles, from 1911 to 1912, amounted in monetary values to 56 per cent. That this rate of increase has been much reduced from 1912 to 1913 and, in fact, would have dropped below zero but for the increased export of German motor trucks and delivery wagons, is ascribed mainly to a world-wide financial depression, taking effect in matters of luxury first; but in some of the markets competition from other exporting countries has been a factor at least equally decisive, as some of the following figures will show. The total value of 1913 exports was 88.3 million mark, as against 76.5 million mark in 1912, and 48.5 million mark in 1911. On the basis of 4 mark to 1 dollar, which is sufficiently accurate for the purposes of comparison, the figures for the present year are made up from the different classes of vehicles, as follows:

	Number of Vehicles		Value in $1,000 Units	
	1913.	1912.	1913.	1912.
Automobiles	7,849	5,025	17,741	16,264
Commercial Motor Vehicles	1,999	695	3,288	1,943
Motorcycles	3,214	3,084	666	623
Dirigible Airships	36	25	334	230
Vehicle Bodies	138	165	45	64

Quantities and Values Reversed

Here it is first remarkable that the much smaller number of automobiles exported in 1913 exceeded in value the larger number sold in 1912; a fact bespeaking perhaps inability to compete with other countries in small cars.

It is also notable that the large increase in the number of commercial motor vehicles is represented by a considerably smaller increase of their aggregate value. This is explained as due to a proportionately larger export of the smaller sizes of trucks, but the statistics, as reported, do not preclude that it may be due, partly or wholly to a lowering of prices.

The exports of commercial vehicles are distributed among the different countries in the proportions indicated by the following figures, which seem to represent a volume or weight unit [not specified in the report] which should be divided by 12 to give approximately the number of vehicles for which it stands.

	1913.	1912.		1913.	1912.
Russia	7,475	5,025	Great Britain	862	476
Brazil	4,375	3,942	The Netherlands	764	210
Austria-Hungary	3,191	2,212	Italy	733	919
Roumania	2,329	998	Argentine	580	564
Turkey	1,077	1,067	United States	418	314
Servia	949	...	Switzerland	390	407
Finland	893	530	Bulgaria	315	375

The increased sale of trucks to Roumania and Servia is attributed to the military needs of these countries, while Bulgaria received her supplies from France.

Returning to the matter of automobiles or pleasure cars, it is explained that the exports during the beginning of the year showed the rising tendency of 1912, but fell off sharply during the last six months.

The distribution to the different countries of the pleasure automobiles is given in the following comparative figures; and it seems that the number of vehicles may again be approximately figured by dividing by 12 in each case. Presumably these figures may also be taken as representing, in a measure, the business possibilities for exporters from countries other than Germany.

	1913.	1912.		1913.	1912.
Russia	23,147	15,937	Roumania	1,290	3,617
Austria-Hungary	9,573	9,791	British So.-Africa	1,095	333
Argentine	7,465	8,122	Uruguay	1,062	1,140
Great Britain	6,726	9,423	Australia	1,049	1,110
Brazil	5,314	9,663	Norway	1,039	672
The Netherlands	4,778	5,172	Chile	1,002	397
Denmark	4,341	2,807	United States	914	889
Italy	4,122	2,503	Mexico	754	329
Belgium	4,035	4,516	Cuba	731	108
France	3,583	3,571	British India	487	514
Sweden	2,782	2,136	Bulgaria	473	696
Switzerland	2,041	1,336	Siam	384	288
Spain	1,886	1,114	Japan	326	366
Finland	1,757	1,494	Turkey	322	378
Dutch Indies	1,557	1,868	Ceylon	196	227
Portugal	1,299	734			

The gains are mostly in Russia, the Scandinavian countries and Italy, while the losses accounted for by foreign competition relate to Argentine and Brazil and, in smaller degree, to Japan, India, Australia and Uruguay.

Exports of Automobile Parts

A considerable increase is noted in the German export of automobile parts. No statistics were compiled on this branch of automobile commerce until 1912, when the total was found to reach a value of about 2 million dollars. In 1913 the total rose to 2¼ million dollars, distributed among Austria-Hungary, Great Britain, Italy, United States, Russia, Belgium, Switzerland and France, the amounts ranging downward in the order given.

The export of automobile motors fell from 2,096 in 1912 to 1,455 in 1913, but their value rose from $365,000 to $650,000, indicating in connection with other factors of record that the motors exported were much larger than before. Holland absorbed one-fifth of this export in automobile motors [under which classification boat motors are probably included—Ed.] The automobile motors imported into Germany were, on the

other hand, smaller and less costly than in the previous year [which may be explained from the number of small automobile motors from United States sent to assembling shops in Germany, together with the other parts of the vehicles to which they were to belong—Ed.].

The total exports of Germany under the heads mentioned in the foregoing amounted to a value of 35.1 million dollars, as against 30 million dollars in 1912. The imports were 6.2 and 5.8 million dollars, respectively.

German Imports

The number of automobiles included in the imports in 1913 was 1830, an increase of 141 over 1912, while the number of commercial motor vehicles dropped from 201 to 159. The principal countries from which the automobiles were bought were United States, France, Belgium, Great Britain, Austria and Italy, in the order of mention. The United States gained almost 100 per cent. over the previous year, overtaking France by a small margin, the French sales remained substantially the same as in 1912. In this there is no account taken of the American vehicles assembled in Germany.—From *Allgemeine Automobil-Zeitung*, January 31.

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Data on Autogenous Welding of Iron and Steel—Special Weld Metal

AUTOGENOUS welding being resorted to more and more to enlarge the field of foundry work, as in the making of hollow cast-steel wheels, where coring would be too difficult or costly, or in securing a water jacket to a motor cylinder casting, where weight may be saved and wasters avoided by employing the process, some of the conclusions which scientific investigators have reached with regard to the best methods to be adopted and the precautions to be observed should now be generally known.

The specialist, R. Amedeo, is quoted on the subject in summary as follows:

Tests made with different flames have established the superiority of the oxy-acetylene flame whose neutrality—chemical inertness—toward iron and steel is absolute. Carburation of the metal is also easy to avoid, as the color of the flame indicates if there is an excess of acetylene. An excess of oxygen is, on the other hand, dangerous; it produces slag deposits which detract greatly from the physical properties of the metal and it is manifested through an important loss in the carbon and manganese contents.

The improvement of welds by hammering and annealing is pronounced. Yet, if the two operations are simultaneous, it is important not to continue the hammering below a certain temperature in order to avoid cracks. The simplest means for determining the temperature at which hammering should cease, in the case of soft steel, is to use a magnet. Its attraction becomes much stronger below 770 degrees centigrade, at which temperature hammering should be stopped.

It seems that the improvement which is most to be desired in practice lies in the use of special weld metals. So far, electrolytic or other iron as pure as procurable has been preferred, but weld metals should be used which are rich in those contents most likely to be burned out in the process. Medium hard and hard steels present special difficulties: their decarburation is always considerable and the welds of two pieces of hard steel usually present the appearance of a steel quenched too cold.

The formation of oxide films on the two pieces is also frequent but can be obviated by means of a mixture of carbonate and bicarbonate of soda in equal parts.

The principal difficulty in welding hard steels lies in the "burning" of the metal, which results in pronounced brittleness and cannot be remedied by annealing. The best means for the prevention of this effect consists in pre-heating the pieces to be welded, so as to reduce the time during which they must be exposed to the flame.

On the whole the welding of steels containing more than .5 per cent of carbon does not present sufficient guarantees for application to parts intended to withstand shocks. The unsuitability of an iron alloy for autogenous welding increases with the carbon content up to a percentage of 2.7. On the other hand, alloys containing more than 4 per cent. are easily weldable.

F. Carnevali, an Italian authority on welding, agrees with Amedeo in preferring the oxy-acetylene flame to the oxy-hydric or the oxy-gas flame, as well as to electric welding or the thermite method; in the case of the two latter methods on the ground of convenience. Welding tests made with steels soft, medium hard and hard—all plain steels but varying greatly in the carbon, manganese, silicon, phosphorus and sulphur contents—and subsequent microscopic examinations and physical tests lead him to the following conclusions:

(1) The rapid heating of the metal alters profoundly its mechanical properties and its molecular structure; often also its chemical composition. These modifications are injurious.

(2) This drawback to the method can be remedied in part by annealing for 30 to 40 minutes at 850 to 900 degrees centigrade. Hammering should be tabooed in the case of hard steels.

(3) Especially in the case of hard steels, the slowness of the cooling is of great importance.

(4) The changes in the mechanical properties—above all the elongation—are due to oxidation resulting in a reduction of the carbon, manganese and silicon contents. The remedy consists in using a weld metal of similar composition to that of the metal to be welded but with a higher percentage of carbon, manganese and silicon.

With reference to cast iron Carnevali's conclusions are different. His tests were made with a composition comprising: carbon 2.94, of which .33 in solution, silicon 2.42, manganese .87, phosphorus 1.47 and sulphur .09. He says:

(1) The rapid fusion and cooling incidental to the welding process give the metal a fine-grained structure.

(2) The chemical composition is affected as in the case of steel, especially the carbon and silicon contents [the manganese is not here specially mentioned] and the remedy lies, as before, in the use of a weld metal rich in these components.

(3) The mechanical properties are only slightly affected by the welding. The welded portion shows, however, increased hardness by the Brinell test.

(4) Heat treatment and the duration of the cooling-period influence the grain of the metal but have small effect on its physical properties. These factors are to be considered, however, for pieces of machines in which expansion and contraction play an important part, as the expansion and also the heat-conductivity are affected by the annealing and the manner in which it is done.—From *Revue de Métallurgie*, January.

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Aluminum Much Improved by Adding Cobalt and a Little Tungsten

CHEAPENING of cobalt—mainly through the expansion of cobalt mining in Canada—has brought the remarkable properties of this metal as an alloy strongly into the foreground. High-speed steels have been greatly improved by its use. Noncorrosive cobalt-chromium-iron, with some carbon, rivals steel in hardness and toughness. And lately it has been ascertained that aluminum with an alloy of 8 to 12 per cent. of cobalt can be rolled and forged, while of coarse crystalline structure and not much stronger than ordinary commercial aluminum. This discovery was followed by the more important one that a further addition of about 1 per cent. of tungsten refined the structure and almost trebled the strength of the metal, while the ductility remained. The alloys with 8 per cent. cobalt are most ductile, while those with 10 per cent. or more are less easily forged or rolled but stronger and more suitable for castings. Molybdenum produces effects similar to those obtained from tungsten in similar quantity.—From *Electrochemische Zeitschrift*, January.

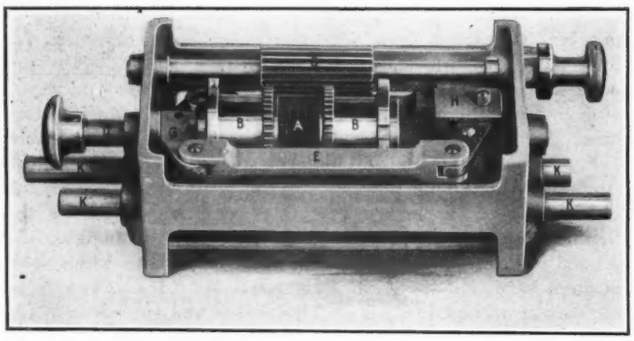


Fig. 1—Bungay automatic gearshift, showing general arrangement

The Bungay Gearshift

Shifting Energy Obtained by Compression of Spring by Clutch Pedal

AN automatic gearshift of the mechanical type has recently been brought out by the Bungay Mfg. Co., Brooklyn, N. Y., to fill the demand for a simple shifting device. Gear changes are made either by a push-button or lever control located on the steering wheel. Energy for the shifting is obtained by compressing a spring by the last half of the downward stroke of the clutch pedal, in other words when the clutch is disengaged preliminary to shifting, the spring is automatically compressed.

As shown in Fig. 1, at A, this spring is held between two cup-like members B which are called selectors. These selectors Fig. 2, are rotated, to obtain the different speeds, by the long gear C whose shaft is linked to the mechanism on the steering wheel. And when the shifter is set for a certain gear selection the gear is meshed by the outward movement of one of these selectors, the energy being supplied by the spring A. When set for any given speed the shifting mechanism is so arranged that the cam on the outer end of one of the selectors engages one of the fingers J, thus moving one of the rods K outward and as these rods K are connected up to the gearbox this movement meshes the desired gear. Before the shift can take place, however, the clutch must be disengaged, in order that the spring may be compressed to provide the necessary power for shifting, this movement also bringing the gear that was in mesh back to neutral. The rod D, Figs. 1 and 3, is connected to the clutch and compresses the spring when it is pushed in.

For the sake of clearness in describing this mechanism, it will be assumed that the outer rod K engages high gear when it moves to the right, and second speed when it moves to the left, the other rod giving low to the right and reverse to the left.

Ordinarily the stops I bear against the selector cams and prevent them from sliding laterally, but when a gear is selected, a notch in one of these cams registers with the corresponding stop and thus the selector is free to move to the right or the left, as the case may be, and the desired gear is then meshed.

Assuming the rods K are connected to the gearbox as described, then Fig. 1 indicates the position of the gearshift for reverse and Fig. 3 shows very clearly the relation of the different parts when second speed is engaged. It will be noted that the rod K is in engagement with one of the selectors *B*, the cam on this selector fitting into a slot in the corresponding finger J. In Fig. 2, also, is seen the method used to hold the other selector in position, its cam bearing against the stop I at the right.

A top view of the mechanism is given in Fig. 4, and a vertical-section through A-A, Fig. 4, is shown in Fig. 5, and from this the relation of the different parts of the mechanism when second speed is engaged is indicated. It is seen that the finger carried on the shifting rod at the bottom is engaged by the edge of the cam and that the notch N is registered with its stop, thus allowing the selector to slide over it. At the top it will be noted that the cam is cut away so as to pass over the finger on this side. By rotating the cam, the other notch might be made to register with the stop and at the same time the top finger would be engaged and the bottom one disengaged. This would be the position of the mechanism for reverse gear.

Free Operation of Clutch

Free operation of the clutch without disturbing the position of the gears is possible during the first half of the downward stroke of the clutch pedal, and during the second half the selectors are brought together and the spring compressed. The linkage for compressing the spring is shown in detail in Fig. 4, the dotted lines indicating the position of the mechanism when the clutch pedal is out.

The Bungay gearshift is offered with two methods of steering wheel control, one by push-buttons and the other by a lever operating in a quadrant. The button control is housed in a round case 4 inches in diameter and 1.5 inches high.

The vital parts of the Bungay gearshift are made of hardened steel and are subject to very little wear, it is claimed. Should they wear, however, it would make no difference because the spring would always push the gears all the way into engagement. On the other hand, the selectors could not wear so much that they would not pull the gears out of mesh.

While the description of the Bungay shifter applies to a three-speed gearset it can easily be installed on a four-speed set by the addition of a third rod K and notching one of the cams to correspond.

This gearshift can be installed on an old model just as easily as on a new car that is designed for its attachment. The work can be done by any mechanic as all that is required is to fasten the box containing the shifter mechanism to the chassis and then connect up the shifter rods to the gearbox. The total weight added by its installation is 18 pounds.

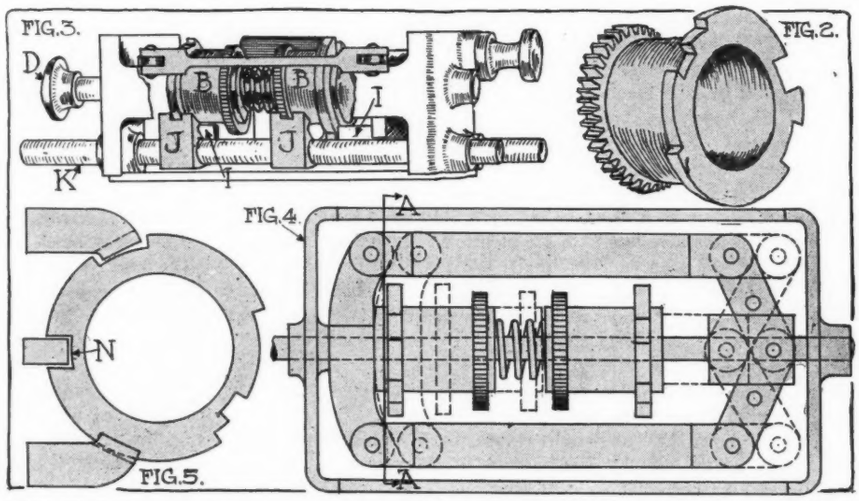


Fig. 2—Selector, showing cam and gear. Fig. 3—Side broken away to show the meshing of selector B with finger J at left. Fig. 4—Top view, showing mechanism for compressing spring. Fig. 5—Section through A-A. Fig. 4, showing position of cam

Stilz Oil Motor Uses 500 Lbs. Compression

Operates on Two-Cycle Principle —Both Fuel and Air Are Pumped In — Develops High Power

A CONSTANT compression motor of very high efficiency employing the two-stroke cycle principle and adapted for running on any of the heavy petroleum oils has recently been brought out by Harry B. Stilz, Philadelphia, Pa.

The motor consists of two working cylinders and a two-cylinder, two-stage air compressor that supplies the air for combustion at a pressure of 500 pounds per square inch. The high compression enables great power to be developed, the engine giving 50 horsepower at 500 revolutions per minute with cylinder dimensions of 5-inch bore and 7.5-inch stroke. No carbureter is used, the fuel being fed directly to the cylinders when the piston is at the top of the stroke by a small pump driven by the camshaft.

The cycle of operation is as follows, beginning with the piston at upper dead center: A combustible mixture of air and fuel is introduced, which ignites almost immediately and drives the piston downward on its power stroke. At lower dead center the pressure of the exhaust gases is reduced to atmosphere by the uncovering of a large exhaust port. The piston then proceeds on the return stroke to the top of the cylinder forcing whatever exhaust gases have remained out through an auxiliary port.

An examination of the vertical section, Fig. 1, shows that the power cylinder, which is the central one in the illustration, looks more like a four-cycle design than a two-cycle one with its intake and exhaust valves mechanically operated by a camshaft on the top of the cylinders. This camshaft is driven by a vertical shaft at the front of the motor through bevel gears. The fuel pumps are also operated from this shaft. As already indicated in describing the cycle of this motor, there are two exhaust valves. One is the main exhaust valve, which is nothing more than a port in the side of the cylinder that is uncovered by the piston when it approaches lower dead center. This port is seen at the left in the figure; the other is the auxiliary exhaust valve which is located in the cylinder head at the left and opens inwardly.

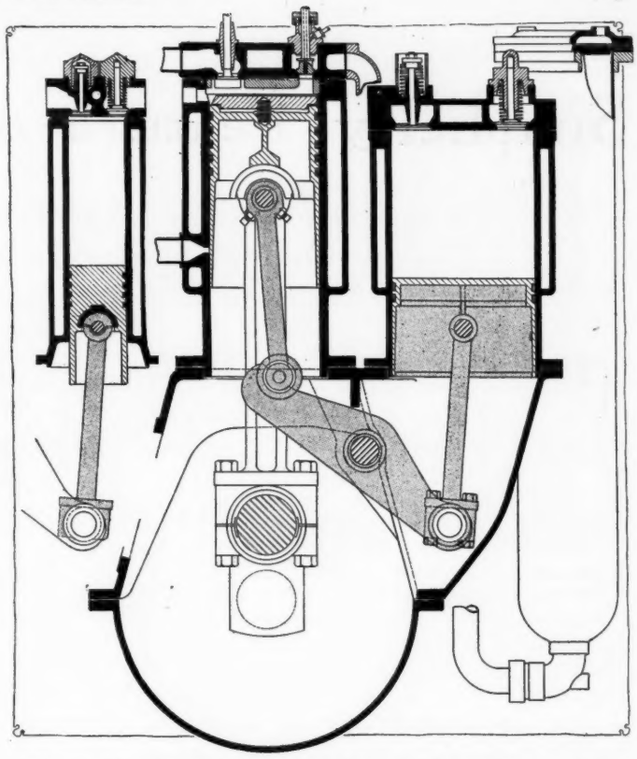


Fig. 1—At extreme left—Section through high-pressure cylinder of air pump. Center—Power cylinder. Right—Low-pressure air cylinder. The compressor pistons are operated from the crankshaft

The air compressor which delivers the air to the power cylinders is a two-cylinder, two-stage type with the cylinders located to the right of the power cylinders. The cut, Fig. 1, shows, at the left, a section through the high pressure cylinder, alone, while at the right a complete section through the low pressure cylinder and adjacent power cylinder is given. The compressor pistons are operated by rocker arms that are pivoted in the sides of the main part of the crankcase. The ends of the rocker arms are connected on one side to the power piston and on the other to the compressor piston.

The operation of inlet and discharge valves is entirely automatic and the cylinders are so proportioned that the pressure of 500 pounds is maintained continuously. From the first stage air is delivered to an intercooler where it is cooled off considerably before it passes to the high-pressure end. This reduces the volume of the air to be handled by the latter and thus a saving in power results. From the high-pressure cylinder the air is discharged into a reservoir which provides the air for starting and running the engine.

In the ordinary motor whether two- or four-cycle, variation in load is taken care of by means of a throttle which varies the compression in the cylinders, but as the amount of compression in this motor is constant, some other means of load variation is necessary. This is done by regulating the amount of fuel delivered to the cylinders by changing the stroke of the fuel pumps.

These pumps deliver oil while the admission valves are open, the oil being injected into the cylinder through a duct in the center of the admission valve, Fig. 2. This duct terminates in a small orifice. Immediately adjacent to this orifice the

(Continued on page 467)

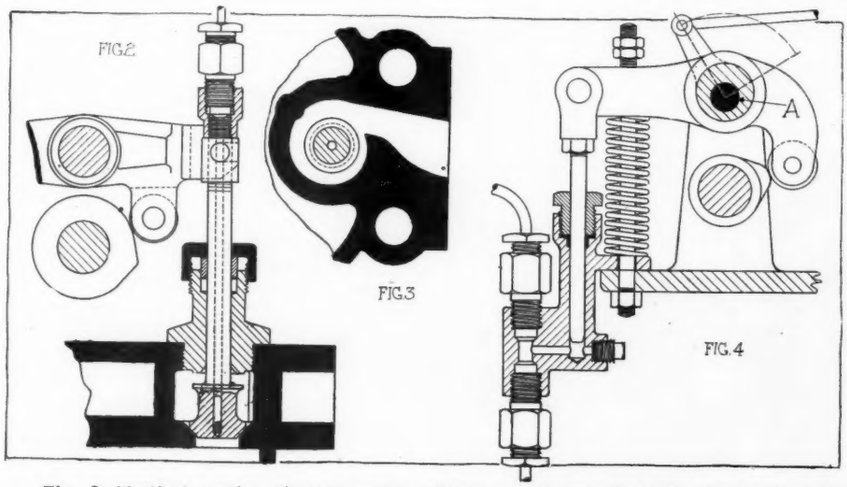


Fig. 2—Vertical section through valve, showing fuel duct through center of valve stem. Fig. 3—Horizontal section through valve chamber, showing spiral form of air passage. Fig. 4—Fuel pump mechanism. The eccentric for varying the stroke is shown at A

Simplicity Feature of G. B. & S. Motor

New Four-Cylinder Type Has Stroke-Bore Ratio of 1.13—Delivers Over 25 Horsepower—Accessibility, Silence and Flexibility Are Aims in the Design—All Moving Parts Are Inclosed

THE latest product of the shops of the Golden, Belknap & Swartz Co., Detroit, Mich., is a four-cylinder motor of the unit-power-plant type which has a bore of 3.75 inches and a stroke of 4.25 inches. These dimensions give a stroke-bore ratio of 1.13, and, according to the S. A. E. formula, the horsepower is 22.5. But, since the stroke is considerably greater than the bore, the motor is capable of delivering 25 per cent. in excess of this rating. The piston displacement is 187.9 cubic inches.

The Golden, Belknap and Swartz concern has long been known as a builder of excellent motors for automobile use, and in the new design we find even greater refinement. Simplicity, flexibility and silence have been especially striven for and the complete inclosing of all moving parts is in line with this aim.

Right Side Practically Clear

The cylinders are in pairs and of the L-head type with water jackets of large size integral. Valves and gas manifolds, and magneto and carbureter are on the left side, leaving the right entirely clear except for the inlet water connections and the electric motor-generator. The crankcase is of the barrel type and gives support to the three crankshaft bearings as well as those of the camshaft. The oil reservoir bolts to the bottom of the crankcase, while on its left side there is a large plate which may be removed to get at the bearings. The left side has two such plates, each inclosing practically half of the length with a breather pipe between.

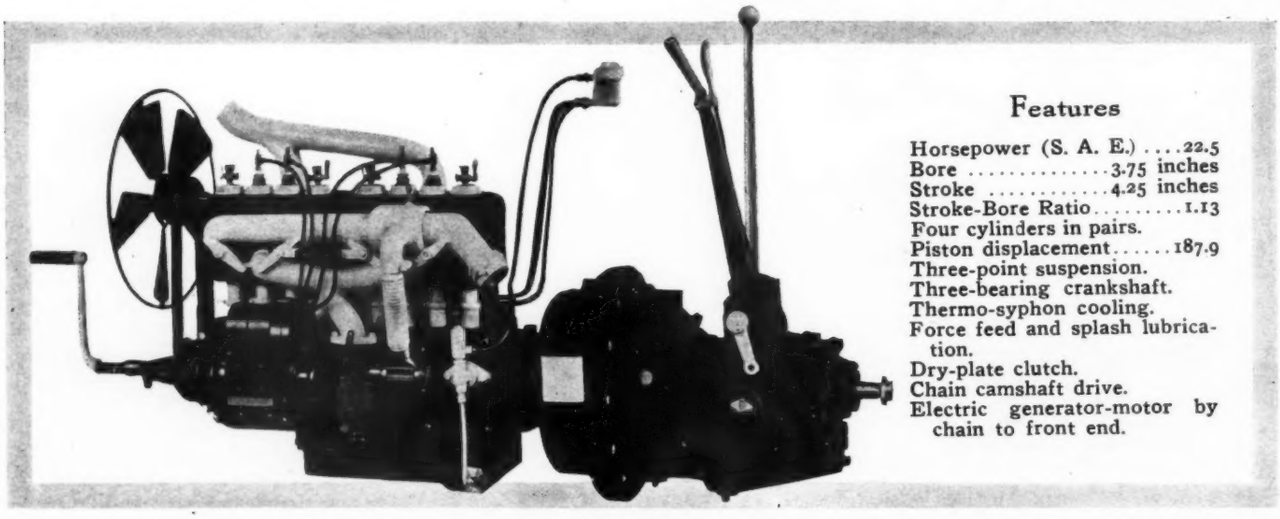
Crankshaft and connecting-rods are made from high carbon steel of rigid analysis and tensile strength according to the maker. Crankshaft and flywheel are given very careful balance on special balancing machines. Such accuracy is an enemy to vibration, racking of the parts and consequent wear and noise.

Timing gears are eliminated in this motor. Silent chains well inclosed at the front end take their place for operating the camshaft, magneto and generator. These can be readily seen in the front view of the motor. One distinctive feature of this chain drive is the provision made for the taking up of the slack which gradually wears in the chains. Those parts of the sprocket and chain housings which carry the magneto sprocket and the electric motor-generator sprocket are separate from the main portions, being held in place by holding bolts. When wear occurs, these bolts may be removed and special gaskets inserted between the two parts to take up the desired chain slack. These gaskets are kept in stock in thicknesses varying from .003 to .02 inch so that all conditions can be met. The motor-generator chain and sprockets are in front of the camshaft and magneto drive. The chain for this passes from the crankshaft sprocket over the camshaft sprocket and on to the magneto shaft sprocket. Thus only two chains are used. These are inclosed so as to run in oil.

Inclosed Parts Are Accessible

Each valve stem and spring is individually inclosed in such a way as to be free from foreign oils and grit, but at the same time they are readily accessible. The tubular housings are telescopic, and when the clamping screw is loosened, the lower part slides upward over the top portion so that the tappet adjustment is completely exposed. Of course, after the valve spring has been removed, the cylindrical affair is easily slipped off.

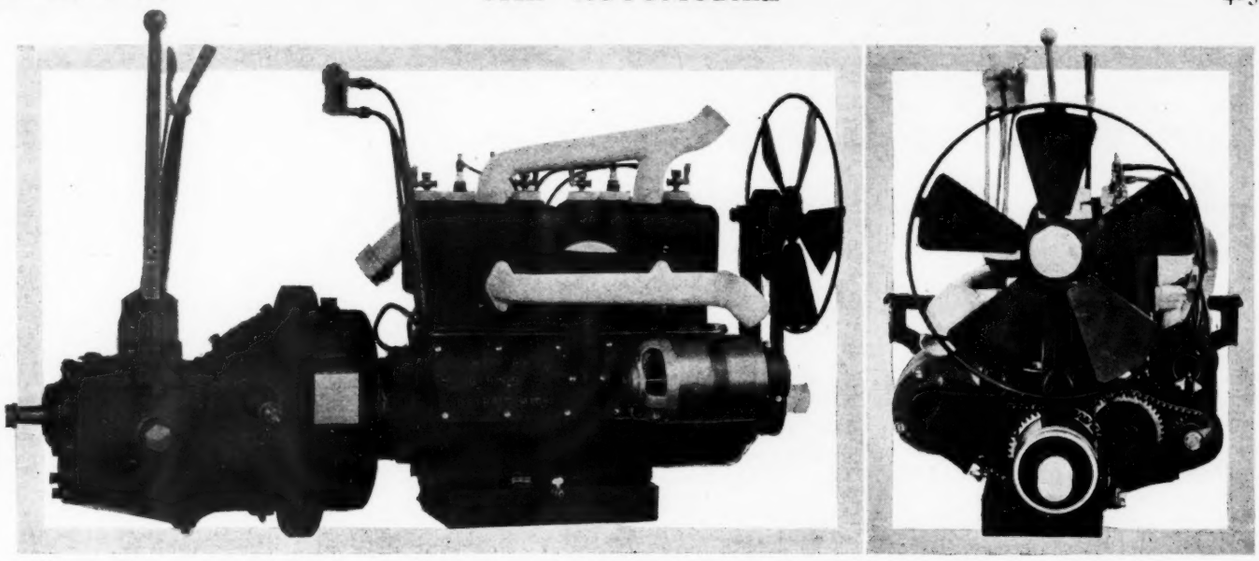
The oiling system is of the combination force feed and splash type, the plunger oil pump operating from No. 4 exhaust cam. This forces the oil first to the dash sight feed and thence to the three main crankshaft bearings. The connecting-rod bearings and pistons are oiled by the splash in the crankcase. The oil is also led to the chain driving mechanism. The motor utilizes thermo-syphon cooling very successfully. The designers realize that thermo-syphon, to be at its best must have large water connections of exactly correct proportions as borne out by experiment, and have provided such. This cooling is well backed up by an efficient shape of fan, belt driven from an extension of the



Features

Horsepower (S. A. E.) 22.5
Bore .....3.75 inches
Stroke .....4.25 inches
Stroke-Bore Ratio.....1.13
Four cylinders in pairs.
Piston displacement.....187.9
Three-point suspension.
Three-bearing crankshaft.
Thermo-syphon cooling.
Force feed and splash lubrication.
Dry-plate clutch.
Chain camshaft drive.
Electric generator-motor by chain to front end.

Left side of the new four-cylinder G. B. & S. power plant, showing how all valves are on this side of the motor. Note oil leads and also control levers mounted on gearbox



Left—Right side of new G. B. & S. motor, showing large water intake manifolds for thermo-syphon system of cooling and mounting of electric generator. Right—Front end view, showing camshaft and generator drive. The two chains shown are the only ones used

crankshaft. The bracket carrying this fan is adjustable at its lower end to give the desired tension to the belt.

The electric motor-generator is placed on the right front side and is of standard make. It performs the functions of first operating through its chain connection the crankshaft, and after the engine has taken up its own running is in turn driven by the former. This electric unit has no connection with the magneto ignition circuit.

Dry Plate Clutch Used

The clutch used with this power plant is a dry plate type having two Raybestos friction disks between which is a steel disk. The clutch is designed for extreme simplicity and ease of operation together with simple adjustment. It is the maker's claim that there are no expensive parts requiring frequent replacement, the only wearing parts under ordinary use being the two friction disks which are guaranteed for a minimum of 2 years' service. The clutch is housed partially within the flywheel housing and partially back of it in the forward extension of the gearbox. This latter bolts conventionally to the flywheel case through a substantial flange construction.

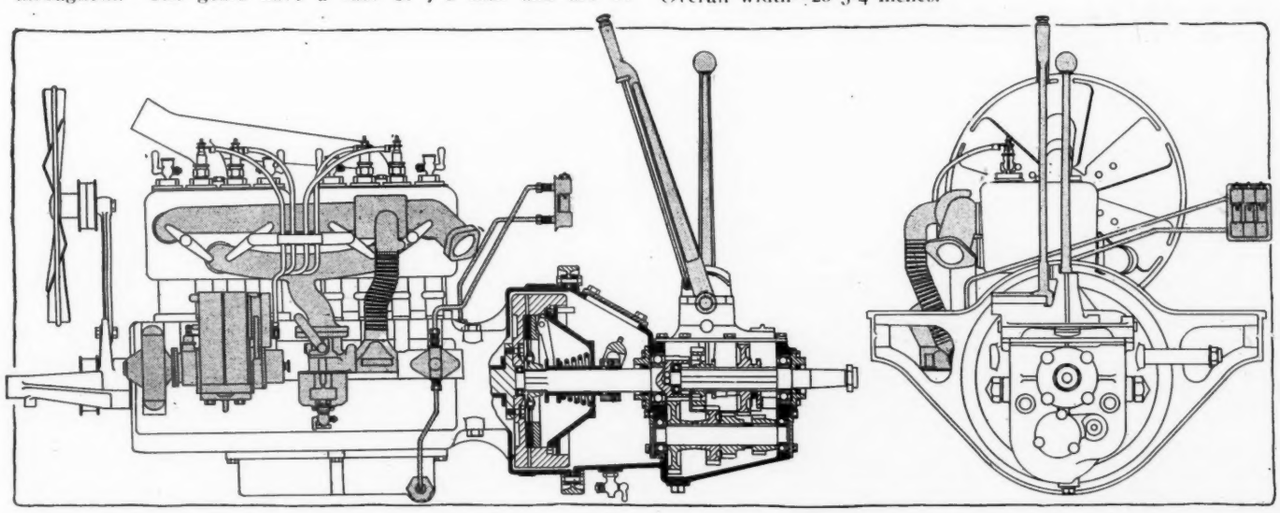
The gearset is a compact unit of standard make, the Detroit Gear and Machine Co. supplying the motor builder with this part. It is a three-speed forward type having ball bearings throughout. The gears have a face of 7-8 inch and are of special steel. This gearset is provided with center control and besides a lever for this purpose, an emergency brake lever is also furnished.

Three-Point Suspension Employed

Conventional method of suspension of this unit power plant is provided for. The three-point design is used, whereby the single support is at the front, while arms extend out for attachment to side frame rails from the flywheel housing. This rear support is not integral with the crankcase, but is attached between the gearcase and the crankcase flywheel housing flange. Thus the gearset may be disconnected entirely without disturbing the engine.

Some dimensions follow:

Crankshaft front bearing—1 1-2 inches diameter by 3 1-2 inches length.
Crankshaft center bearing—1 1-2 inches diameter by 2 3-4 inches length.
Crankshaft rear bearing—1 5-8 inches diameter by 4 inches length.
Connecting-rod lower bearing—1 1-2 inches diameter by 2 inches length.
Flywheel diameter—11 1-2 inches.
Flywheel width—3 3-4 inches.
Overall length power plant from front support to rear of gear assembly—48 inches.
Overall width—26 3-4 inches.



Left—Elevation of left side of G. B. & S. power plant, with sectional view of clutch and gearbox. Right—Rear view of power plant. Note supporting arms

Some Accessories for Use on Cyclecars

Motorcycle Types Predominate at Present But Many Special Cyclecar Devices Have Already Appeared

TO write of cyclecar accessories is largely to retell the story of motor and motorcycle accessories as the larger part of the cyclecar supplies to date are merely adaptations from these fields. Tires are motorcycle tires, speedometers are motorcycle types, lamps are those used by motorcycles, and as a rule, wheels, rims, pulleys, etc., all are taken from the motorcycle field.

At the beginning all the fittings were of the motorcycle type but experience has shown certain requirements which have influenced makers to changes and in some cases to entirely new designs.

For instance there has been a change in motors and shortly there will be a greater change, leading probably to new designs which can be made cheaper than present motors without sacrificing results in any way. The first cars were made with motorcycle motors and these worked well for a time, but were soon found to have deficiencies which were glaring. They were too hard to start, the shafts were too light, and they would not throttle down enough for traffic. Fitting outside flywheels added to connecting rod strains, and therefore many changes were needed. as a result the makers of this type of motor for cyclecars have made their motors to fit. Decompressers were fitted on magneto fitted motors and for others battery systems, especially the Atwater-Kent, were adopted and found to give starting on the first throw of the crank. This change was made together with a strengthening of construction all the way through and today the Spacke Machine Co. of Indianapolis and the Universal Machinery Co. of Milwaukee are making V motors well fitted to this work. Both of these engines have been previously described in these columns. They come within the 71-inch cylinder capacity which is generally accepted as the cyclecar limit, and have proved well equal to their work. Both are fitted with fans for assisting cooling.

Carbureters Adapted to Cyclecars

One of the difficulties in starting the V motors by the quarter-crank-turn method necessary in cyclecars was found due to mixture and to carbureters, which, though well fitted for motorcycles, did not deliver the right starting mixture for cyclecar requirements. The first to consider the cyclecar and to produce a carbureter for this field was the Wheeler & Schebler Co., which is now making a real cyclecar carbureter.

The new product is similar to the old model H, but with extra shutter adjustments for starting with a rich mixture, one butterfly valve being fitted in the air intake below the jet, and the extra air valve arranged so that it can be held shut by pulling a wire from the dash.

This carbureter is being used by both the Spacke and Universal Machinery companies.

A large percentage of the new type cyclecars are using belt drive and as a result are demanding belting in large quantities and yet require a low price. A low price demands low priced material and the firms as a result have either had to continue their price or cheapen the product to its detriment. It is significant that there has been little price changing. One firm has produced a very original belt especially for cyclecars but this type would not be so successful on the small pulleys of motorcycles as it is on the larger pulleys of the cyclecar as can be seen from the construction.

This belt resembles on the outside an ordinary block leather belt of the V type, the continuous strip which takes the strain in the ordinary belt looking rather light for the load however. A glance at the belt coupling shows, however, that within the continuous strip are imbedded two woven piano wire cables of enormous strength and that these cables take all the strain of the pulling while the leather merely furnishes the wearing surface. A set of these belts made a very remarkable performance on the recent trip of the Imp from Detroit to Erie, Pa., over the worst of road conditions for in the whole run, in snow, water and mud and with new belts neither was tightened once and have run some time since without touching. A trip of 28 miles in deep snow and ruts was made on one belt, after the breakage of a pulley, with no appreciable slippage. This belt is made by the Duckworth Co., and is called a cyclecar belt.

Demand for Good Belts

The Graton & Knight Co., pioneer belt maker of Worcester, Mass., is also specializing in belting for cyclecars and has placed its belt with a great number of the cyclecar makers. It reports the greatest sale for the 1 1-8-inch belt and has run many tests with this size to determine the best sizes of pulley for the best results. The company naturally decries small pulleys which turn the belts at small angles and is in favor of large pulleys of generous width and extra depth. The engineering department is open to give advice to any firms including belt drive in their product.

The cyclecar movement has come so fast that it has been a surprise to many firms which at first could see nothing in the new vehicle. When inquiries began to result in real orders however, they began to take notice and now these firms are planning on a large percentage of their output being for cyclecar trade.

Special Hubs for Cyclecar Work

A few months ago for instance it was impossible to obtain hubs for cyclecars other than sidecar hubs, and these were considered too narrow and light for the new work. There are a number of firms now making special hubs for cyclecars, and the Mott Wheel Works, the Lindsay Wheel Co., and G. H. Rehfeldt, of Forest Park, Ill., are making complete wheels of cyclecar type.

A hub especially for cyclecars is made by the Harris and Reed Co., Chicago, this hub having a 4-inch distance between flanges and generally being strung up with the greater length of hub outside, to give the wheels the benefit of a dish. The hub comes complete with annular ball bearings and spindle as shown.

The Standard Welding Co. is making special cyclecar rims, special belt pulleys and special hubs with brake drums integral, besides many minor constructions for individual cars. The Eclipse Machine Co., of Elmira, N. Y., and the New Departure Manufacturing Co., of Bristol, Conn., are planning to supply a large number of cyclecar hubs and brakes for the coming season.

Lighting so far is much the same as on motorcycles, but there is a feeling that the electric light is going to be adopted when the makers perfect devices now under test. These are electric combination ignition-and-lighting equipments and are offered by the Vesta Accumulator Co., of Chicago, and the Wells Electric Co., of Fond du Lac, Wis. The first named is a 2-volt outfit very applicable to cyclecars through its very light weight and low cost, and in combination with an ignition coil and timer with a single cell storage battery furnishes light and ignition at the cost of an ordinary magneto, while the storage battery is always kept charged and hence the system need give no more trouble than a magneto. The generator is about the size and weight of a magneto and is sufficient to furnish a headlight and tail light and have ample overhead capacity to keep the battery stored.

The Wells outfit is similar but of standard 6-volt proportions, more standard but heavier and costlier, though having greater capacity. The field also is wound and not of the permanent type. Each company states that it has found a large demand for the installation and is planning for big business.

Marburg Bros. are making a special set for electric lighting similar to the motorcycle lighting outfit made by the firm but larger to take care of two headlights and a tail light. This outfit consists of a dynamo driven by a pulley rubbing on the tire, is light and efficient, but uses no storage battery and hence must depend on other supply when standing still.

One Dual System on the Market

To meet the growing demand for a small magneto which can combine the battery system for starting the Ericsson Mfg. Co., makers of the Berling Magneto, is bringing out a dual system, and expects a large market for the product. Battery systems are excellent for starting, but are not noted for speed work. With the dual magneto the battery system can be used for starting and the magneto switched on when running as in big car practice. This is undoubtedly an ideal system, but of necessarily high cost, since the complete ignition systems are included.

In gas lighting sets the Badger Brass Co., of Kenosha, is specializing in outfits for cyclecars and is advertising special cyclecar lamps.

Axles for cyclecars are being made by the Cyclecar Engineering Co., Indianapolis. The Warren Electric Machine Co., of the same city, and the De Cross Cy-Car Co., of Cincinnati.

By another year the number of makers of cyclecar accessories will be a formidable array, while for one year's growth the present list is indicative of the basis of the movement for many of the firms have been forced into the work against their first belief and are now boosting enthusiasts.

Stilz Oil Motor Uses 500 Lbs. Compression

(*Continued from page 463*)

the duct has a spiral groove cut in it which fills the cross-section of the duct, and which causes the oil to spin violently in its discharge so that it spreads itself out into a hollow cone-shaped film. It will be noted by a study of the horizontal section, Fig. 3. through the valve chamber that compressed air enters the admission valve tangentially so that it too will be discharged into the engine cylinder in a whirling current thus causing the oil to be perfectly atomized and uniformly mixed with it.

The success of this engine depends almost wholly upon the ability to secure a perfect mixture of air and atomized oil without any appreciable throttling of the air at the point of admission. This combined admission valve and spray nozzle plays an even more important part in the operation of this type of engine than does the carbureter in the gasoline engine.

A view of the pump mechanism is shown in Fig. 4, with the means for changing the stroke clearly illustrated. The plunger is operated through a rocker arm which takes its motion from a cam on the camshaft. Variation in pump stroke is obtained by means of eccentrically pivoting this rocker. This is done by fitting an eccentric sleeve between the pin shown at A and the rocker arm. By rotating this sleeve by means of the rod shown at the top, various pump adjustments can be obtained while the motor is running. The spring shown forces the roller against the cam and by adjusting the nuts that hold this spring in place, the maximum stroke of the pump may be regulated by determining just how closely the cam contour shall be followed.

At the left in Fig. 4, the fuel pump is shown in section, the plunger is seen at the right, the discharge valve is at the top on the left and the suction valve at the bottom.

Electrical ignition equipment is used only in starting; as soon as the motor becomes warm the heat retaining linings on the top of the piston and cylinder head become hot enough to ignite the charge.

It is hardly necessary that the use of these linings increases the thermal efficiency of the motor by greatly reducing the amount of heat radiated to the water jackets. This feature in connection with the high compression employed gives a very economical motor, it is claimed.

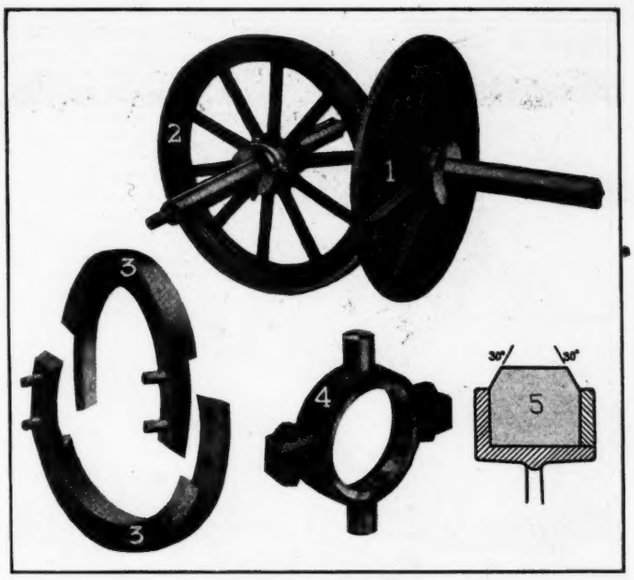


Fig. 1—Friction disk for cyclecars made by the Rockwood Mfg. Co., Indianapolis. Fig. 2—Wheel member of speed change. Fig. 3—Showing how fiber ring is split to facilitate removal. Fig. 4—Split collar. Fig. 5—Section of beveled friction ring

Parts for Friction Drive on Cyclecars

Friction Disks and Wheels, Fiber Fillers and Split Collars Made by Indianapolis Concern

PARTS for cyclecar friction drives are made by the Rockwood Mfg. Co., Indianapolis, Ind. Complete change speed sets are not manufactured but friction disks and wheels, fiber fillers and split collars may be had in sizes suitable for any cyclecar design.

The disk, Fig. 1, is an iron casting, webbed on the back to give rigidity without great weight, and is a pressed fit on to the driving shaft.

Speed changes are obtained by moving the wheel, Fig. 2, over the surface of the disk. This is done through a suitable linkage operating on the split collar attached to the hub.

In order to properly transmit the driving effort from the disk to the wheel the coefficient of friction between the two surfaces must be high. For this reason the rims of the Rockwood Company's friction wheels are fitted with a tarred fiber ring, which has a very high coefficient thereby allowing a maximum force to be transmitted, and for which great wearing qualities are claimed.

The allowable working pressure for this material is 250 pounds per inch of width. In order to prevent the fraying of the edges the friction ring should be beveled, as in Fig. 5.

The horsepower that this drive will transmit is:

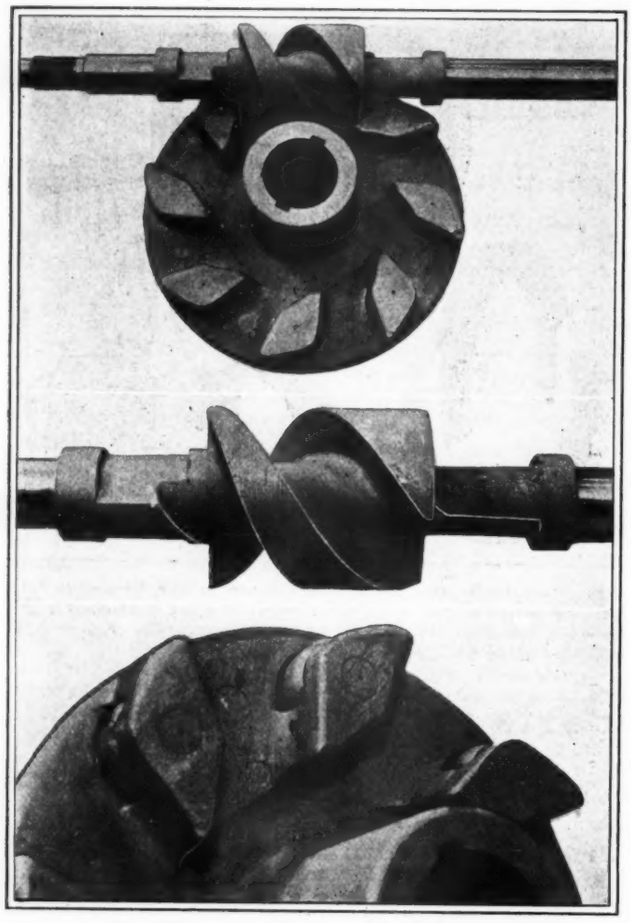
$$H.P. = .00055\ D\ W\ N,$$

where

D = mean diameter of driving wheel in inches,
W = total effective width of fiber friction face,
N = revolutions per minute of disk.

W should not exceed 1-12 D and the disk and wheel diameter should be the same for best results.

The fiber ring is split to allow of its removal and replacement without the necessity of dismounting the friction wheel and is firmly held in place by dowel pins and bolts as indicated in Fig. 3.



Top—Fleury worm gear with the worm mounted on the side of the worm wheel. Middle—Fleury progressive pitch worm gear. Bottom—Detail illustration of the worm wheel, showing rollers set in the teeth

New French Worm Gear Has Variable Pitch

Has the Worm Mounted on the Side of the Wheel—Efficiency 95 Per Cent.

PARIS, Feb. 7—A worm gear having a variable pitch and with the worm mounted on the side of the worm wheel, has been invented by Fleury and Gauthier, two French engineers, and is being applied to automobile rear axles by one of the leading firms in Paris.

The claims made for this worm gear are a decreased overall area, for the diameter of the housing is little more than that of the worm wheel, whereas in the usual construction with a tangential action the diameter of the worm has to be added to that of the wheel. The result is a housing which interferes with the floorboards at the rear, or an inadequate clearance and the necessity for inclining the motor, gearbox and driveshaft.

Although the lateral mounting of the worm is not entirely new, it is claimed that this is the first case in which it has been completely worked out theoretically and given a practical application. There are examples of worms operating between two worm wheels, but this arrangement is theoretically incorrect and can only be made to work by leaving a considerable amount of play in the gearing. The Fleury lateral worm gear employs a single worm wheel and the worm engages with it without play. It naturally places itself in the correct position, at the correct distance from the center of the wheel, and it is impossible to place it otherwise.

Full Length of Worm Used

The variation of the pitch is constant and regular, there being not the smallest length in the thread where it can be said that it is of any definite pitch. The result gained by this variation is that the worm follows up the retreating tooth and thus the full strength of the worm is always being exercised on the full strength of the tooth. The teeth in engagement with the worm are always immersed to their full depth. In the ordinary worm gear only one tooth can be in full contact, while the others vary. The amount of contact before and after the tooth in full contact depends of course on the size or diameter of the wheel. In the Fleury system the contact of all the teeth touching the worm is complete to their full depth, no matter what the size of the gear.

Rollers Used in Wheel

In most cases the gear wheel is cut out of phosphor bronze and a roller is set within the tooth. This facilitates repairs in case of breakage of a tooth. Laboratory tests indicate that the minimum efficiency of the worm is 95 per cent. These tests were carried out with an automobile type of worm with a reduction of 1 to 4. One of the test gears has been kept running constantly for 7 days and nights at 3,000 revolutions of the driveshaft, transmitting full load. Lubrication presents no difficulties whatever.

In the matter of silence the Fleury gear is decidedly superior to the bevel and compares very favorably with the worm. The manufacturing methods are such that uniformly quiet gears are assured.

Equipment Feature of I. M. C. Service Station

(*Continued from page* 454.)

a hub cap it would be quite natural for a customer to kick, but if it were also stated that the hub threads were all banged up and had to be chased before the cap could be attached, no complaint would be made by the customer.

From these job tickets the cost record, at top, Fig. 1, is made out and from this the customer is billed. Any unusual occurrences in the work that would tend to stretch out the time spent on the job, as instanced above, are carefully set down on the customer's bill, so that he will be able to determine for himself whether the charges are fair. The company states that since adopting this policy the matter of collection of bills has become a very simple one.

There is one more feature about this plant that calls for more than passing notice, and it teaches a lesson that is important. This feature has to do with the attitude of the company towards its employees. Exceptionally good treatment is given the men when they are injured with the result that lawsuits for injuries are unknown. Also very noticeable is the cordiality that exists between the men in charge and the workmen.

Commerce Co. Has New Service Plan

DETROIT, MICH., Feb. 14—A new idea in co-operation and service was put in operation by the Commerce Motor Car Co. of this city, maker of the 1,000-pound delivery car of that name, when it gave a smoker to the local owners and operators recently. The meeting was held at its new sales rooms at 541 Woodward avenue and was somewhat in the nature of a house-warming. Talks were given by T. C. Moeller, of the Bosch Magneto Co. and by the Commerce service man. This was the first of a series of educational meetings that will help each operator to learn how to keep his car up to the highest point of efficiency.

Exhaust Gas Analysis for Economy

(*Continued from page* 443)

and was never less than 1.5 per cent. Probably the setting was for maximum power. A showing of but 9.9 miles per gallon, equivalent to 23 ton-miles is therefore not surprising.

Analysis and Performance Differ

The showing of Car No. 12 is good for the most part, in so far as the gas analysis is concerned. Only while idling or accelerating is the percentage of CO_2 below 10, while in most cases it is over 12 per cent. Furthermore, the quantity of CO is small, forming only a trace, in fact, in most of the samples. Since the car is light and the motor a small one, one would expect, judging by the analysis, a better showing than 20.7 ton-miles per gallon. There is, of course, a reason for this apparent discrepancy, but the data obtained in this test does not reveal it. There may have been a lack of compression in the motor or the spark may not have been well timed, or again there may have been excessive friction in some part. It is impossible to say which of these or other factors were the cause.

Results of Tests on Truck Motors

The cars numbered 13, 14 and 15 were of the commercial type weighing from 4 to 11 tons. They were, of course, fitted with solid tires and ran at very low speeds as compared to the pleasure cars. For these reasons and for others the ton-miles per gallon should be higher than for the cars whose showing has already been discussed, providing, of course, that the combustion is equally good.

In the case of Car 13 we find evidences of a mixture which is a trifle rich, there being from 2 to 3 per cent. of CO in most of the exhaust gas samples—probably indicating a setting for maximum power. The average ton-miles per gallon for this car are 43.4, which is seen to be higher than that obtained in any passenger car. Doubtless this mileage could have been increased to 50 by regulating the mixture for maximum economy—that is, by decreasing the gas supply for the same volume of air.

The cars numbered 14 and 15 are really the same car. The figures under Column 14 show the performance of the car without load, while those in Column 15 apply to condition under load. In the first case the gas analysis indicates practically perfect combustion. Only traces of CO are present, and the O_2 and CO_2 run about right for good economy. In the second test, with the truck carrying a load, the mixture was a trifle richer during some runs, although the combustion was still good. The conditions as to speed and gear used were not the same in the two cases, hence a strict comparison is not permissible. It is worthy of note, however, that the miles per gallon were about the same whether the truck was loaded or not, so that the ton-miles per gallon were much higher for the run under load.

Conclusions

It is worthy of note that the first sample taken (with engine running idle, car standing) contained in almost every case a considerable proportion of CO, showing poor combustion. In many cases plenty of oxygen was present to support combustion, but the gasoline had evidently not been broken up, vaporized and mixed with the air as it should have been, with the result that it went through the motor only partly burned. Some of this loss is doubtless due to the rich mixture used to make starting easier, the throttle for these runs being in about the starting position.

A similar state of affairs is evident, though not so marked, in the second sample, taken while car was accelerating after idling. In this case the CO may doubtless be laid in part to the picking up of particles of gasoline which had previously condensed in the inlet manifold.

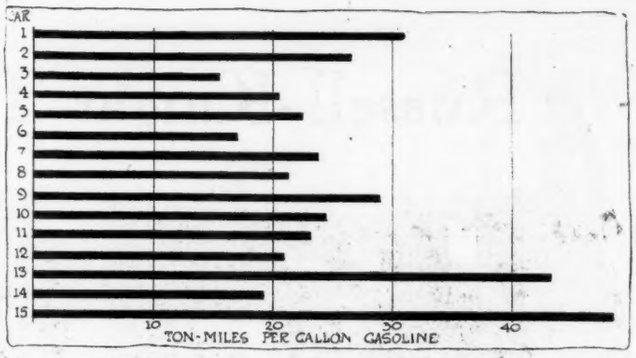


Fig. 4—Ton-miles per gallon of gasoline of the cars tested

The foul smelling exhaust which may often be noticed when a motor is idling or when picking up is another evidence of the poor combustion which then frequently prevails.

In the other cases general conclusions are more difficult to draw, but it is apparent that there is considerable opportunity for improvement in the average case. One tendency, which is not without reason for being, is that of setting the carbureter to give a rather rich mixture in order to secure a snappy, fast burning charge and good power. This, in reality, is supplying hydrogen, which burns rapidly and easily, while permitting considerable partly-burned carbon to be thrown away without yielding all its available heat content. This, of course, is a wasteful method, but one which gives results when the cost of fuel is a matter of little consequence.

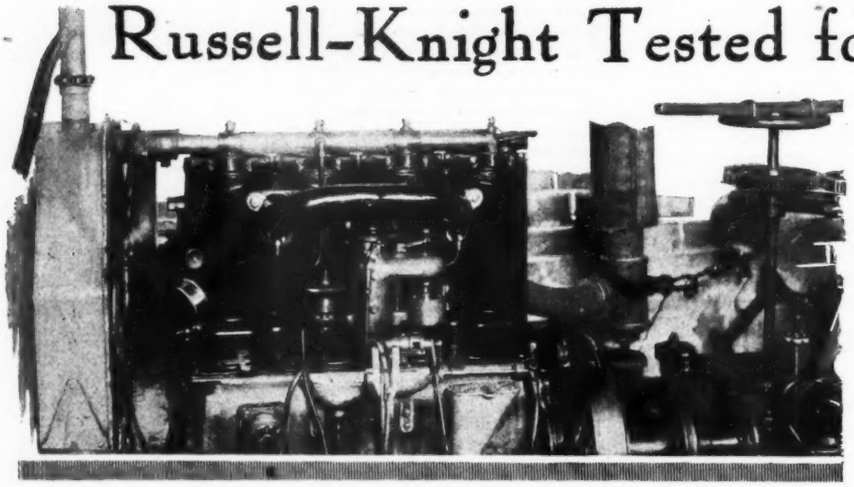
One other set of conditions, and a very desirable one, is conspicuous by its absence, or rather its infrequent occurrence—that is, the condition which yields high CO_2, not more than a trace of CO, and 3 to 4 per cent. of O_2. It will be recalled that Professor Watson's curves show this condition to obtain when the ratio of air to gas is about 17 to 1, and that with this ratio the highest efficiency is obtained. There can be no doubt but that excellent economy in fuel will be realized when this condition can be brought about.

Factors Determining Consumption

It might, perhaps, have been expected that the cars which showed the highest ton-miles per gallon would be the ones whose motors exhausted gas having the least CO and the greatest per cent. of CO_2. Such would doubtless be the case if the degree of completeness of the combustion were the only factor which determines the consumption per ton-mile. A number of other factors play a large part in determining this quantity, however, such, for example, as the frictional losses in the tires and other parts, average throttle opening, area exposed to wind resistance, etc., to say nothing of the degree of skill with which the car is handled. Comparison of the data in the table will show this to be the case. One conclusion can hardly be contradicted, however—and this is one of the very things this discussion is intended to emphasize—namely, *that those cars which show but few ton-miles per gallon and poor combustion would show a considerable improvement if the combustion were made complete by following the rules laid down above, and that those cars which showed good ton-mileage per gallon in spite of poor combustion would show still greater efficiency if the combustion should be improved.*

That there is ample room for improvement can be seen by a glance at the record of analyses. From 3 to 4 per cent. of CO, *showing a loss of about* 15 *per cent. of the fuel seems to be very common, while nearly* 7 *per cent. of* CO, *indicating a loss of about* 25 *per cent. of the heat in the fuel due to incomplete combustion, was found in some instances.* Surely this is a condition which should be remedied, and one which should receive careful consideration by engineers—particularly those seeking to develop efficient motors and carbureters—and all others interested in the subject of fuel economy.

Russell-Knight Tested for 300 Hours



Averages 35.6 H.P. Throughout Run

Speed R.P.M.	Horse power	Torque Ft. Lbs.
502.5	15.02	157
597	18.25	161
699	21.7	163
800	26.0	170.7
903	30.2	175.6
999	33.5	176
1100	37.0	176.5
1203	40.75	178
1300	45.0	182
1403	49.0	183
1503	51.5	180
1600	54.6	179
1700	55.7	172
2000	63.5	167

TORONTO, ONT., Feb. 10—A 300-hour test of a Russell-Knight sleeve valve motor has been completed by the University of Toronto, through its department of Applied Science and Engineering. The test was superintended by Professor H. W. Price for the Russell Motor Car Co., Ltd., Toronto. The test differs from previous long-duration ones in that the motor was run at different crankshaft speeds for 24-hour periods. The test started with a 24-hour run at 500 revolutions per minute, the speed was then raised to 600 revolutions per minute for 24 hours and for successive 24-hour periods it was raised to 700, 800, 900, 1,000, 1,090, 1,200, 1,300, 1,400, 1,500, 1,600 and 1,700 revolutions per minute.

Develops 10 H.P. Above S. A. E. Rating

The motor, which was a stock Russell-Knight, four-cylinder type with cylinders 4 1-8 by 5 1-2 with an S. A. E. rating of 27.2 horsepower, showed an average of 35.6 for the 300 hours or 31 per cent. above its official rating.

The official rating is based on a piston speed of 1,000 feet per minute and the motor was run for 24 hours at 1,090 revolutions per minute, which gave this speed. The average for this period was 37.2 horsepower, exactly 10 horsepower above its rating, and representing 36.75 per cent. increase above the official rating. The motor during the test generated its official rating of 27.2 horsepower at 840 revolutions per minute instead of at 1,090 revolutions per minute.

Throughout the test the Stromberg 1 3-4-inch carbureter was not adjusted, but was set with wide-open throttle. The Mea magneto was changed with every increase in speed up to 1,100 revolutions per minute when its maximum advance was reached.

At the conclusion of the 300-hour run the engine was started on a series of 1-hour runs at 500, 600, 700, 800, 900, 1,000, 1,100, 1,200, 1,300, 1,400, 1,500, 1,600, 1,700 revolutions per minute, and 5 minutes at 2,000 revolutions per minute. The carbureter settings were left exactly as in the 300-hour run. The results appear above.

Horsepower Rises Quickly

The horsepower curve shows power rising more than proportionately to speed up to 1,400 revolutions per minute, just as in the 300-hour test. It shows 63.5 horsepower at 2,000 revolutions per minute. It shows that the maximum horsepower would not be reached before 2,500 to 2700 revolutions per minute. Obviously this engine showed no lack of ability to take and use a full charge of mixture at 2,000 revolutions per minute. The power at 2,000 revolutions per minute was 233 per cent. of rated horsepower.

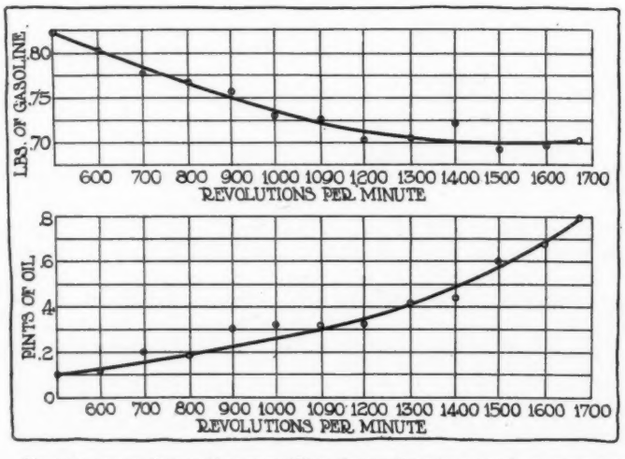
The torque curve shows torque at 2,000 and 700 revolutions per minute to be identical. It shows no sign of the bend in Fig. 3, between 500 and 600 revolutions per minute, which substantiates a statement made later that horsepower and torque for the first 24-hour run were low because of the initial extra friction of a new stock engine.

The testing brake was of balanced hydraulic reaction type.

Observations were made of torque and actual speed every 10 minutes, and hourly of gasoline gauge, jacket water temperatures inlet and outlet, oil temperature, oil pressure on bearings, exhaust pressure, and room temperature. Oil and gasoline supplies were noted as required. Gasoline was measured by a Bowser pump, and temperature noted of outflowing gasoline so that these volumetric measurements could be correctly reduced to 60 degrees Fahrenheit. The pump was carefully calibrated.

During test several spark plugs were changed, the motor was shut down once owing to the automatic sprinkling system flooding the test room and on the 297th hour the top ring in the cylinder head chipped and caught the top of the inner sleeve, breaking a piece out of it and so the compression of the cylinder was lost and the cylinder did not give any power during the last 3 hours of the run. After the test was over and before the series of 1-hour runs was made a repair was effected.

The spark plug in No. 3 cylinder was changed after running 15 hours at 1,400 revolutions per minute. The central electrode was burned down to the porcelain. The plug in No. 2 cylinder had a 3-8-inch spark gap when removed. After these plugs were changed the horsepower rose from 45.8 to 49.75.



Upper curve shows the quantity of gasoline in pounds per brake horsepower hour. Below, the pints of oil consumed per gallon of gasoline

The total quantity of gasoline consumed was 7,771 pounds, or 1,082 Imperial gallons, or 1,299 U. S. gallons. The total oil consumed was 54.8 gallons. The total work done by the engine was 10,680 brake horsepower-hours. The average horsepower during this work covering all speeds from 500 to 1,700 revolutions per minute is 1-300 of 10,680 or 35.6 horsepower. The average gasoline consumption for all speeds was .727 pound per brake horsepower-hour.

The outlet water temperature was held around 140 degrees Fahrenheit, during the test by withdrawing hot water from and supplying cold water to the top of the radiator.

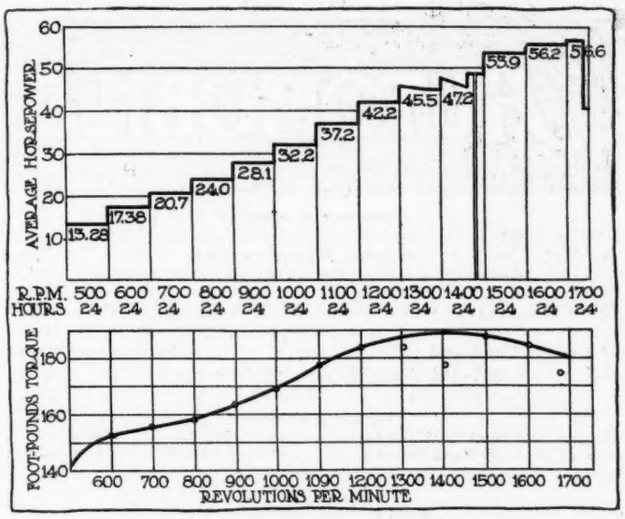
Breaks All Lubrication Records

Lubrication of the engine was carefully observed. It will be noted from the results that this engine went through the test with very much less oil per brake horsepower hour, or per gallon of gasoline consumed, than any other engine of either poppet or sleeve valve type on official record. Each day throughout the test oil was fed into the intake for a 10-minute period to see whether or not the upper end of the sleeves would run more freely, but no difference could be detected. Examination of the sleeves after the test revealed well run-in surfaces with no mark suggesting lack of lubrication. The exhaust gases were free of oil smoke, and were practically invisible during the test. The oil was maintained at a mean temperature of about 140 degrees Fahrenheit. It was necessary to water-cool the bottom of the oil pan to hold the temperature down to 140 degrees during the higher speeds when the engine was developing 45 to 58 horsepower. At times the temperature went as high as 154 degrees Fahrenheit for short intervals.

Condition of Parts

After completion of all tests the starter was tried. It whirled the engine quite as usual. The engine was idled at 180 revolutions per minute with no change from previous carbureter settings, and ran well at that low speed. The air pump for tires and gasoline tank pressure pumped quickly to 300 pounds per square inch at 180 revolutions per minute showing that valves and piston fitted perfectly. The oil pump which had held about 50 pounds per square inch on the bearings through all the tests showed the same high pressure. Hence the pump was in good condition and no bearings were loose. There was a fracture in the oil pan on one side above the oil level. Altogether the engine appeared quite ready to undergo a second similar test.

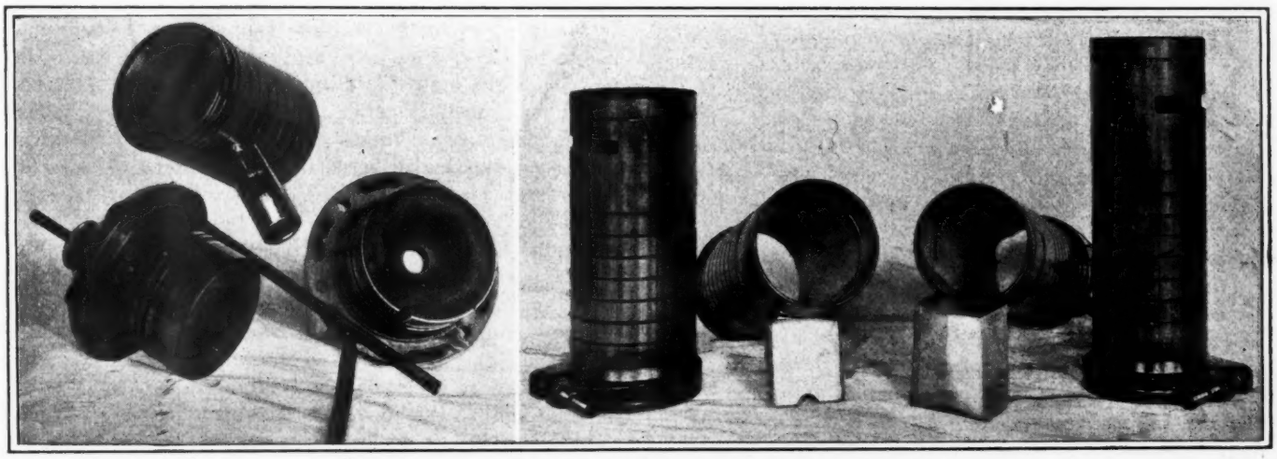
The engine was then completely pulled down. The pistons, sleeves, and cylinders were round and true, and showed polish marks of perfect fitting. The exhaust ports in the cylinders were clear and clean. The exhaust ports in the sleeves showed about 1-32 inch carbon deposit on the edges, the piston heads had a slight carbon deposit around the edges, but tool marks were visible elsewhere. The cylinder heads were quite clean, small pieces of crust being in evidence here and there. The broad junk rings were well bedded to the sleeve walls. The bearings of crankshaft, eccentric shaft, rods, and wristpins were snug, and quite ready for use in car service. Most of the bearings bore a polish. The chain drive for the sleeves was slightly loose, but not in need of adjustment.



Step chart shows the average brake-horsepower during each day. Below, curve showing the variation in the torque at various speeds

AVERAGES IN 300-HOUR RUN OF RUSSELL-KNIGHT MOTOR

Hours From	Hours To	Averages R.p.m.	Averages B.h.p.	Gasoline Lbs. Per B.h.p. hr.	Pints of Oil Per Gal. Gasoline
0	12	500	12.95	.822	.096
12	24	500	13.61		
24	36	600	17.33	.802	.104
36	48	600	17.41		
48	60	698	20.38	.780	.120
60	72	698	21.02		
72	84	795	23.76	.769	.192
84	96	801	24.24		
96	108	901	27.65	.756	.304
108	120	905	28.55		
120	132	1008	31.96	.735	.320
132	144	1001	32.44		
144	156	1093	37.09	.725	.320
156	168	1093	37.31		
168	180	1203	41.93	.702	.324
180	192	1205	42.47		
192	204	1304	46.00	.706	.420
204	216	1302	45.09		
216	228	1401	46.94	.720	.440
228	240	1401	47.75		
240	252	1499	53.64	.693	.600
252	264	1501	54.10		
264	276	1600	56.50	.698	.680
276	288	1602	55.90		
288	300	1700	52.60	.701	.800



Cylinder heads, piston and sleeves after the test, showing clean condition of the surfaces

The Automobile

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Salesmanship That Counts

WITHIN the last 4 months a representative of a well-known truck maker was waited upon by an industrial house owning a fleet of many trucks of a rival make, the object of the visit being to open negotiations for replacing the existing truck fleet with that make represented by the dealer. The industrial head was apparently ready for a change; at least, there were other makes of trucks that were to his way of thinking, giving better satisfaction.

Instead of the truck dealer saying, "Here is my chance to down the other fellow and blazon the name of my truck across a country," he counselled against a change, on the ground that it would not be economic to the industrial house; in other words, it would be poor business to discard at slaughter prices a fairly satisfactory article in order to put a little better one in its place. Rather the truck dealer argued for a gradual replacement, as the old vehicles went entirely out of commission.

Here was a truck dealer that counselled, as he thought, for the benefit of the buyer, rather than for his own immediate gain. Loud publicity was within his grasp, but he withheld, preferring to act on a policy more for the eventual good of both buyer and seller than for great immediate benefit to the seller and heavy expense to the buyer. This course of conservatism left the truck field with a much cleaner slate. Would that more truck dealers and salesmen would look to the best interests of the buyer as well as the seller, and do the entire industry a good turn at the same time.

Chemistry in Carburetion

IF best results in motor efficiency are obtained when a mixture of 15 to 1 by weight of air and gasoline are exploded, and if carbureter makers are working assiduously along divers lines to get such results, why should not more attention be given to the practical aspects of exhaust gas analyses, with a view of accurately discovering if the explosive mixture is being well consumed in the combustion, or if the products of combustion show a sad lack of economy?

When samples of exhaust gas are taken under practical road conditions they are bound to show the economies or extravagances of carburetion. Taking these samples from the car on the road while it is pulling the steep grade, moving slowly through traffic, idling by the curb, or operating under any one of the other five or six representative road conditions, is certain to furnish an accurate clew as to the merits of carburetion and the efficiency of the motor.

On other pages of this issue are given the results of a dozen different makes of cars with different types of motors from which analyses of the exhaust gases taken over the same road surfaces and under identical conditions were made.

These analyses show exceptionally good combustion in some motors and bad in others. In some cases it was a question of poor carburetion, and in others the difficulty seemed to go beyond the carbureter to the motor. Making successive tests after carbureter adjustments demonstrated that with certain adjustments it was possible to get almost ideal combustion, whereas with other adjustments the combustion is not complete.

It would seem desirable for carbureter makers to devote more attention to this active testing on the road, it being generally acknowledged that the rôle of the carbureter is to give satisfactory results on the road. Carbureters can be adjusted to give good results with a car stationary, but not satisfactory results with it traveling on the road.

Making exhaust gas analysis of the car in actual service should give results of value for the carbureter maker who is endeavoring to get the last word in efficiency from the given amount of fuel consumed by the engine. The tales told by exhaust gas analyses are of equal value to the engineer who has developed the motor, and is endeavoring to bring it to the highest point of efficiency.

Many car owners are quite ignorant of leading facts connected with fuel consumption. Few stop to realize that when the motor is idling by the curb, it is often consuming as much gasoline as when it is carrying its passenger load at 15 miles per hour along the highway. These are facts that have been demonstrated time and again and are potent arguments in favor of the self-starter and the rational use of it by the driver. It is a common occurrence to see large limousine cars standing by the curb in the city for one-half hour or longer at a time, and with the motor idling throughout. Although gasoline consumption has not been a considerable factor with such car owners, it is coming into consideration more and more each year, and although some makers are arguing against the starter on the town car on the ground that the chauffeur does not require it, it nevertheless remains a fact that there are economies in its use.

"Let Manufacturers Fix Prices"—Joy

WASHINGTON, D. C., Feb. 14—In advocacy of "price maintenance," Henry B. Joy, president of the Packard Motor Car Co., appeared today before the judiciary committee of the House of Representatives.

Mr. Joy urged the continuation intact of the Sherman anti-trust act with the interpretation that a maker may fix a universal price for his products. He said in part:

"We have the astonishing condition of the Sherman Act on the statute books for 25 years and today it is not known whether under the provisions of that act, definitely and finally, a manufacturer of an article has the right to fix the retail price at which his product is to be sold to the consumer.

"Most manufacturers believe as I do that the highest form of business conduct is for the manufacturer to maintain a fixed price, to all his patrons, so that all may be treated with equality and exact fairness.

"We have come to know that mere bigness is no crime. We have come to know that stable prices, even though made by so-called trusts, are a vast benefit compared to the feverish variations and uncertainties of the cut-throat competition days.

"Private rebates, cut prices, special concessions, have been much mitigated. The conditions today are better, to an almost infinite extent than before the consolidations of the trust era.

"Prices are more stable. An enormous amount of villainous, unfair, cut-throat competition has been eliminated, and a condition of live and let live exists.

"The attitude of the government, according to pending litigation, is that the control of retail prices by the manufacturer must cease if his goods are sold through the natural channels of trade, the wholesalers and retailers and not through his own established agencies.

"The right of a manufacturer to fix the retail price of his article has been the custom from the beginning of time.

"Take the condition of a publisher, who manufactures a copyrighted article. How could you possibly conduct a successful publication if you could not print its price on the face of it?

"Should a publisher be permitted to maintain a fixed schedule of advertising rates as sold through advertising agencies all over this broad country?

"Is it not clear that fair competition is promoted by permitting the manufacturer to fix and maintain his retail price, whether his article is patented or copyrighted or branded with his personal stamp of quality?

"My friend, Henry Ford, occupies the center-stage limelight position today! Why? Because he is at the head of an enormously successful manufacturing industry which he has built up by his genius and the aid of those he has associated with him—his co-operators. Henry Ford owns 51 per cent. of the stock of what is, I believe, the most successful industrial corporation in America. Its capital stock is $2,000,000. Last year it paid, I believe, $10,000,000 in dividends and added as much again and more to its surplus. Its business at present is increasing by leaps and bounds.

"In my opinion if Mr. Ford could not fix the retail price and maintain it he could not conduct his business successfully for one moment, to say nothing of building it up to its present colossal magnitude.

"This Congress should by the simplest possible acts permit and make it lawful for the manufacturer who may desire to maintain his retail prices to advertise his goods and protect his patrons and guide them into paying the proper price which he may see fit to ask. If he asks too high a price he will quickly be compelled by fair competition to lower it.

"With the already well adjudicated Sherman Law in the records and such a perpetual business tribunal to control great corporate business unaffected by changes of political administrations, and to enforce fair competition and to prohibit unfair competition, we will have taken a long step in restoring the confidence of the people in free government."

—

TORONTO, ONT., Feb. 14—The figures of the Russell Motor Car Co. for the past 2 years prove beyond doubt what a benefit to the community at large such a big industry might be. In its shops and offices alone the firm all the year round has an average of 1,240 people and has expended $1,678,132 in wages and salaries during the 2 years.

—

NEW YORK CITY, Feb. 17—The Kelly-Springfield Tire Co. has declared a quarterly dividend of 1.5 per cent. on the preferred capital stock, payable April 2.

Analysis of Export Figures for 1913

WASHINGTON, D. C., Feb. 14—As briefly reported last week the combined exports of pleasure cars and commercial cars during December last, numbered 2,389 cars, valued at $2,152,144, while in December of 1912 the number was 2,013 and the value $2,060,812. During the calendar year 1912 the number of pleasure and commercial cars was 23,720, and the value was $23,703,989, while during the calendar year 1913 the number had increased to 26,889 and the value to $27,029,451.

The detailed exports, and imports by countries during various periods, are given in the accompanying tables:

EXPORTS OF AUTOMOBILES AND PARTS FROM THE UNITED STATES

EXPORTED	December				Twelve Months Ending December					
	1912		1913		1911		1912		1913	
Automobiles:	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value
France	30	$29,123	120	$100,418	420	$449,757	698	$531,163	921	$710,149
Germany	12	18,516	58	45,810	115	124,615	450	366,914	1,017	857,103
Italy	21	16,335	12	11,236	176	199,986	288	257,050	314	270,315
United Kingdom	269	215,753	648	484,299	4,031	3,380,266	4,640	3,518,671	5,152	3,966,600
Other Europe	110	116,532	160	135,183	795	718,360	1,549	1,295,379	1,846	1,570,678
Canada	557	604,560	227	307,170	4,988	5,552,931	7,421	8,859,694	6,051	8,177,256
Mexico	41	86,937	14	21,254	297	490,041	27	459,023	227	408,148
West Indies and Bermuda	54	60,660	72	70,166	300	343,281	370	391,890	527	515,762
South America	342	374,183	239	234,905	1,116	1,356,445	2,201	2,539,166	2,713	3,008,045
British Oceania	273	239,961	495	431,530	2,476	2,217,762	3,385	3,091,966	3,564	3,286,860
Asia and other Oceania	181	176,011	137	134,891	813	795,576	1,650	1,640,369	2,367	2,353,788
Other countries	123	122,241	207	175,282	280	295,341	794	752,704	2,190	1,904,747
Total	2,013	$2,060,812	2,389	$2,152,144	15,807	$15,924,361	23,720	$23,703,989	26,889	$27,029,451

IMPORTS OF AUTOMOBILES AND PARTS INTO THE UNITED STATES

IMPORTED	December				Twelve Months Ending December					
	1912		1913		1911		1912		1913	
Automobiles and parts of:	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value
Automobiles, no duty	87	$227,652	38	$93,655	972	$2,098,481	868	$1,999,587	492	$1,154,873
Parts of (except tires), duty	..	12,694	..	138,487	...	347,767	...	275,819	...	447,938
Cars, Carriages, etc.:										
Automobiles:										
France	43	100,589	22	56,187	341	770,643	469	1,123,584	196	467,167
Germany	7	19,523	1	3,570	160	350,239	63	152,860	81	214,701
Italy	10	18,909	5	9,240	131	203,733	109	174,412	85	153,039
United Kingdom	15	51,523	6	16,990	173	403,506	137	347,776	54	161,667
Other countries	12	37,108	4	7,668	167	370,360	90	200,955	76	158,299
Total	87	$227,652	38	$93,655	972	$2,098,481	868	$1,999,587	492	$1,154,873

Stromberg Co. Wins in Carbureter Suit

Chicago Court Holds that Zenith Carbureter Infringes Patents Owned by Stromberg—Regarded as Test Case

CHICAGO, Feb. 13—Judge A. L. Sanborn in the District Court, Northern District of Illinois, has handed down a decision today stating that the Zenith carbureter infringes the Ahara and Richard patents owned by the Stromberg Motor Devices Co., of this city. The decision comes in the suit brought by the Stromberg company, makers of the Stromberg carbureter. against the John A. Bender Co., Chicago, agent for the Keeton car, which car uses the Zenith carbureter. It has been looked upon as a test case and it is believed the decision will have an important bearing on the carbureter situation.

Judge Sanborn, after reviewing the case in the light of the Ahara and Richard patents held by the Stromberg company, and the Baverey patent owned by the Zenith Carbureter Co., Detroit, manufacturer of the Zenith instrument, couched his verdict briefly as follows:

"Plaintiff (Stromberg) is entitled to a decree adjudging validity of the Ahara patent, and infringement by the defendant (Bender)."

This Stromberg-Zenith carbureter controversy has proven one of the most interesting legal cases of the past year, and while the test case was between the Stromberg company and Bender, it was nevertheless considered as a test on the scope and validity of the respective patents. The Stromberg company controls the Ahara patent No. 684,662, and the Richard patent, No. 791,501. It brought suit against Bender on the ground that the Zenith carbureter was an infringement of these patents. On the other side, the Zenith company owns the Baverey patent, No. 907,953, which it considered basic in its carbureter design, and looked upon the Stromberg design as an infringement of this patent.

Stromberg has been and now is manufacturing under the Ahara and Richard patents, a type of carbureter known as the atmospheric-well type, that is a type in which the proper mixture is maintained on the various engine speeds by means of an auxiliary supply of fuel from a well which communicates with the atmosphere and which is fed from the constant-level fuel chamber.

The Ahara is held to be a pioneer patent broadly covering this fundamental idea and the Richard patent covers an improvement over the Ahara invention. The decision was not based upon any alleged infringement of the Richard patent, for the court held that this is a specialized improvement on the Ahara device designed for the same purpose and it is not necessary to consider whether it is infringed by the Zenith device, in as much as infringement against its basic patent, the Ahara is found.

The Zenith company holds the Baverey patent but the court held that the Zenith, as made, did not strictly follow this patent in all respects and in its present form has substantially the same principle of operation as the Ahara or Richard, or either one of them, assuming all three patents being valid, as the court thinks they are.

Judge Sanborn held that claims, 1, 2, 4, 6, and 7 of the Ahara patent are infringed by the Zenith device; and further that the Ahara patent was not in anywise anticipated by Crossley in his English patent No. 24,584 of 1893, which was the best prior disclosure cited.

In considering the relative merits of the Ahara and Baverey patents the court argued as follows:

> But the real question is, whether the Zenith device as made, not strictly following the Baverey patent in all respects, has substantially the same principle of operation as Ahara and Richard, or either one of them, assuming all three patents to be valid, as I think they are.
>
> The conflicting devices may be roughly illustrated by the letter L inside of the letter U, thus: Suppose the two tubes or conduits are supplied with gasoline from a constant level tank, whose upper level is a little below the level of the left-hand upper ends of the L and U, and that the lower horizontal end of L is connected with this tank. Also, that the L tube has a small opening into the U tube, so that the fuel may run into it, and that the L tube is closed to the air except at its top or nozzle, while the U tube is open to the air at its upper right-hand end.
>
> So the question here is whether the carbureter claimed to infringe, although made generally under Baverey, has the same principle of operation as Ahara, though the latter was not working to the same end, and though his device has had no effect on the problem of carburetion for automobiles.
>
> Both the Ahara and Zenith devices agree generally in the following particulars: Referring to the L and U tubes, the lower end of L is connected with the float-chamber, and the right-hand upper end of U with the air. With the suction on the upper left-hand ends of both tubes the effect is to pull fuel through L and air through U. L and U being connected, the fuel will run from L to U by gravity, so that both tubes will supply fuel to the mixing chamber at low speeds. As the pull increases with the speed all the fuel will be pulled out of U, and air only supplied by it, thus thinning the mixture, and preventing the over-richness occurring with a carbureter using only the L tube or single jet. This is the same result obtained by Krebs with his auxiliary air valve. With more economy of space and a cheaper device, perhaps a better result.
>
> It will be readily understood that if the U tube has an opening to the atmosphere so large as to keep normal air pressure in that passage, fuel will run into it from L, and be carried along to the mixing chamber with the air in U and the fuel also in L; but if the opening to the air is restricted a slight vacuum will occur in U, with little or no fuel. So, in order to obtain the object sought, of making the fuel leaner as the speed increases, the air-opening in U must be properly restricted, sufficiently to produce the best result, as shown by trying it out.
>
> At this point the claims of Baverey and Ahara meet literally, as they do substantially in other respects. Referring to the U tube Baverey claims "a chamber open to the atmosphere, and Ahara "a passage communicating with the atmosphere." Ahara's claims admit of restricting the opening so as to get a slight vacuum in U. This is what he does, and so does the Zenith company in the devices shown in evidence. If the Zenith were made substantially like either figure 1 or 2 of the Baverey drawings it seems there could be no infringement, because there would never be any subatmosphere in U. But the infringing Zenith device restricts the opening in the upper part of U to one or two very small holes, while the drawings show the right-hand leg very much enlarged, with its upper end either wide open or covered only with a wire screen.

R. & L. Sues for Lindsay Axle Royalties

INDIANAPOLIS, IND., Feb. 16—As an echo of a suit brought recently to collect back royalties, the Rauch and Lang Carriage Co., has filed suit to collect $12,500 it paid in advance royalties to Thomas J. Lindsay and Willard Harmon for the use of the Lindsay axle. The suit is directed against the Lindsay Auto Parts Co., which succeeded Lindsay and Harmon in the patent rights to the axle. The Rauch and Lang Carriage Co. claims it should have its money returned because other electric vehicle companies have been allowed to use the axle.

Some time ago the Lindsay Auto Parts Co. sued Rauch and Lang, for $3,600 alleged to be due in back royalties. It claimed that the total royalties due were $16,100 of which $12,500 had been paid in advance at the time the contract was entered into.

Ask Sale of Walpole Assets

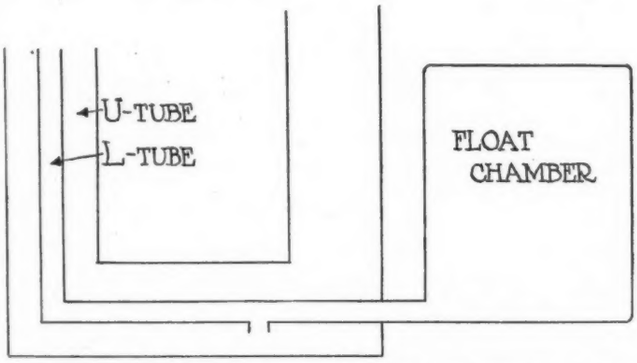
BOSTON, MASS., Feb. 15—Permission to sell the assets of the Walpole Tire & Rubber Co., was requested by the receivers yesterday at a hearing before Judge Dodge in the U. S. District Court. Whether the reorganization plan goes through or not the receivers recommend a sale.

The assets on January 1 were valued at $777,776.94 of which $132,347 represents cash on hand, $231,520 bills receivable and $413,908 represents raw material, supplies and finished and unfinished goods. It is said that funds were on hand sufficient to pay a dividend of from 5 to 10 per cent. to creditors. Pending report from the receivers on the amount of money available for dividends, the hearing was continued for 2 weeks.

Receiver for Gilson Starter Plant

INDIANAPOLIS, IND., Feb. 16—Judge John J. Rochford of the Marion County superior court has appointed Charles W. Mabey receiver for the Gilson Motor Starter Co. of this city, and has instructed the receiver to operate the plant until it can be disposed of at private sale.

The suit asking that a receiver be appointed was filed by F. H. Langenskamp, who claims an account of $244.44. Mr. Langenskamp says that the company is unable to meet its debts and is in imminent danger of insolvency.



Construction involved in the Zenith-Stromberg litigation. This is known as the atmospheric-well type of carbureter and is designed to give a proper mixture at different engine speeds by a well that communicates with the atmosphere

Prest-O-Lite Tests Trade-Mark Law

Brickner Auto Supply Co. Sued by Prest-O-Lite for Refilling Tanks —Suit Based on Trade-Mark Law

NEW YORK CITY, Feb. 17—A statute under the General Business Law states that any person engaged in manufacturing, packing, bottling or selling any article of merchandise put up by him with his name or trademark on it, shall be deemed the proprietor of that trademark and shall have the right to recover a fine of $100 from any one who shall sell from or out of that article any substance other than the original contents placed therein by the proprietor of the trademark. This law was passed in 1909, but has never been construed by the courts.

The Prest-O-Lite Co. has brought suit against the Brickner Auto Supply Co., for refilling gas tanks carrying the Prest-O-Lite trademark. Louis Lande, the attorney for the defendant, attacks the constitutionality of the law on the ground that it is retroactive.

The Searchlight Gas Co. and the Prest-O-Lite Co. are the principals behind this suit. The latter company had the field to itself under its patents on the tanks up to 1912 when the Searchlight Gas Co. secured a decision from the United States Courts declaring that the patent of the Prest-O-Lite Co. on the tanks had expired in 1910, and its right to the name had therefore expired with the expiration of the patent. But the Prest-O-Lite Co. took advantage of the trademark law passed in 1909, explained in the opening paragraph, and filed a claim with the Secretary of State that the name Prest-O-Lite applies to the gas with which these tanks are filled.

The Searchlight company claims that after the expiration of the patent it has a right to fill Prest-O-Lite tanks with its own gas as long as no fraud is practiced on the purchaser, and that the Prest-O-Lite Co. cannot restrain the further refilling of the tanks because it sells the tanks outright at a price of $25 each. The result of this litigation is of much interest, because there are over 750,000 tanks sold by the Prest-O-Lite Co., and the purchasers naturally want to know just what their rights are and what they can do with these tanks.

Johns-Manville Answers in Klaxon Suit

NEW YORK CITY, Feb. 17—The H. W. Johns-Manville Co. has filed an answer in the United States Court for the Southern District of New York to the complaint of the Lovell-McConnell Mfg. Co., in which it claims an infringement on its patents 923,048, 923,049 and 923,122.

In its answer the defendant denies that these patents are capable of conjoint use and that it has or is so using them. It also denies any infringement. It avers that the claims of these patents are each invalid and void because the said alleged inventions had been patented or described in certain printed publications prior to Hutchinson's alleged invention. It also avers that the claims are invalid in view of some 14 other patents, naming eleven British, three French and one German patents.

Claims Infringement on Clock Patents

NEW YORK CITY, Feb. 14—The Phinney-Walker Keyless Clock Co., this city, has brought suit in the United States District Court for the District of Connecticut against the New Haven Clock Co. The complainant claims infringement of the Phinney-Walker patent on rim-wind automobile clocks, No. 967,428, issued to Phinney Adams, August 16, 1910. This complainant placed its product on the market 5 years ago and is one of the largest manufacturers of clocks for automobile general purposes in the country.

New Anti-Speed Law in New York

NEW YORK CITY, Feb. 14—One of the most important of the proposed automobile ordinances recently introduced by the Board of Aldermen is that which fixes a definite minimum term of imprisonment for violators of the speed and traffic regulations. For the first offense the minimum prison term is fixed at 24 hours and the maximum term 15 days. The minimum prison term for the second offense is fixed at 3 days and the maximum term at not more than 30 days. For the third and every subsequent conviction the minimum prison term is fixed at not less than 5 days or more than 30 days.

Violators of this ordinance can only be regarded as second and third offenders if these offenses happen within a year after the conviction for the first offense.

MILWAUKEE, WIS., Feb. 14—The motor truck fender ordinance "died" in a council committee room after representatives of the Stegeman Motor Car Co. produced statistics to show that only 10 per cent. of the city's motor accidents were caused by trucks and that none of these were caused by the front wheels.

CHICAGO, ILL., Feb. 14—The law in Chicago requiring trucks to carry fenders is not being enforced for the reason, according to the head of the traffic department, that no standard fender has been found. They are looking for a type of fender which will be applicable to all makes and styles of trucks, and still do what is required by law. Nothing is expected to be done for at least 3 or 4 months.

To Fight Maryland Fee Increase

BALTIMORE, MD., Feb. 14—Resolutions urging the passage of certain automobile legislation and demanding that the present registration fee remain without increase were passed tonight by the Automobile Club of Maryland. Among the club's recommendations are these laws:

1. Requiring lights on all vehicles using the roads of this State at night.
2. Establishing reciprocal relations with the District of Columbia.
3. Retaining the present rates of speed for motor-vehicles.
4. Abolishing local town regulations as to speed.
5. Establishing the traffic rules governing vehicles and pedestrians as prescribed in the bill prepared by the Commission appointed by the Governor to draft such traffic regulations.
6. To refrain from passing any laws increasing the present fees charged for the registration of motor vehicles.

It was voted to publish the resolutions in pamphlet form for widespread state distribution.

The Baltimore Automobile Dealers' Assn. passed similar resolutions on February 7.

Bretz Terminates with Hartford Parts

NEW YORK CITY, Feb. 14—The J. S. Bretz Co. announces today that it has terminated in every particular its selling relations with the Hartford Auto Parts Co., the latter company marketing its own product in the future. Meanwhile the J. S. Bretz Co., will confine its operations to the importation and selling of F. & S. ball bearings, German chrome steel balls, and the Bowden Wire mechanism made in England.

FINDLAY, O., Feb. 14—At the annual meeting of the stockholders of the Grant Motor Co. held recently the former board of directors was re-elected and officers for the year were chosen. The board of directors includes: D. Grant, Charles A. Grant, David A. Shaw, George S. Waite, George S. Salzman, James M. Howe, H. J. Koehler and A. Freschl. David A. Shaw was elected president; George D. Grant, vice-president; Herman J. Hoehler, vice-president; George W. Waite, secretary; David A. Shaw, treasurer. George S. Salzman was appointed factory manager; James M. Howe, engineer, and George S. Waite, sales manager. The Grant Motor Co. is now making rapid progress and shipments from the factory are averaging 20 cars per day.

Paige Moves Into New Plant

DETROIT, MICH., Feb. 17—The Paige-Detroit Motor Car Co. has finished moving into its new plant located on McKinstry avenue, corner of Fort street in the West End of Detroit. The plant is near to the Detroit river, within a block of the Timken factory and close to one of the Studebaker Corp. plants. It has unequaled railroad facilities and is one of the largest single factory buildings in the city. The main portion of the plant has a frontage of 790 feet on McKinstry avenue and is constructed of glass and concrete of the latest factory design. The width of this part is 60 feet. The stock room, boiler room and pump house adjoin the main structure on the rear, and add considerable floorspace. The stock room measures 72 by 92 feet. All told the floor space is 170,000 square feet, the buildings being three stories in height. Not a single car was held up in production by the change.

Mitchell Sells Wagon Business

Will Concentrate on Automobiles —$2,700,000 Is Added to Capital

RACINE, WIS., Feb. 16—The Mitchell-Lewis Motor Co., Racine, Wis., announces the sale of its entire farm wagon and vehicle business to a syndicate of eastern capitalists who have organized the Mitchell Wagon Co., with $500,000 capital, and will henceforth devote its attention exclusively to the production of the Mitchell car.

The purchase price is kept secret, but the company states that by the transaction it is enabled to pay off its entire gold note issue and there will be added to its operating capital for the motor car business approximately $2,700,000. The concern is capitalized at $10,000,000. The deal means the permanent and stable financing of the Mitchell-Lewis Motor Co., which for two years or more has been repaying a loan of some $2,500,000 made in 1911.

The transaction was confirmed at the annual meeting of the stockholders. It was decided to sell the wagon plant and devote all attention to the motor car business. The sale was thereupon formally made to the Mitchell Wagon Co., which was incorporated a week ago with $500,000 capital by George N. Fratt, John B. Simmons, Raymond Weins, Milton J. Knobloch and John B. Rowlands.

As a temporary arrangement, the officers of the Mitchell-Lewis company will manage and handle the wagon plant until the new owners effect a permanent organization.

At this meeting directors were elected for the Mitchell-Lewis Motor Co., as follows: H. L. McClaren, William T. Lewis, Frank L. Mitchell, Warren J. Davis, John W. Bate, Otis C. Friend and Martin J. Gillen. The officers are: President, H. L. McClaren; first vice-president and general factory manager, John W. Bate; second vice-president, W. T. Lewis; secretary, W. H. Armstrong; treasurer, F. L. Mitchell.

The wagon plant now sold represents the nucleus of the present Mitchell-Lewis organization. It was established as the Mitchell Wagon Co. by Henry Mitchell, at Fort Dearborn, now Chicago, in 1834. In 1845 the business was moved to Kenosha and in 1857 to Racine. William T. Lewis, who married Mr. Mitchell's daughter, joined the firm in 1864 and it became the Mitchell & Lewis Co. In 1884 the business was incorporated as the Mitchell & Lewis Co., Ltd. In 1902 W. T. Lewis and his son, Capt. Wm. Mitchell Lewis, organized the Mitchell Motor Car Co., which was operated as a separate corporation until 1910, when all of the various Mitchell and Lewis interests were consolidated in a $10,000,000 corporation under the title of Mitchell-Lewis Motor Co. The annual output is 8,000 motor cars and 30,000 farm wagons.

Government Departments Want Trucks

WASHINGTON, D. C., Feb. 17—*Special Telegram*—The general supply committee will open sealed proposals, March 19, for furnishing the executive departments, and other government establishments here with gasoline and electric motor trucks during the fiscal year beginning July 1 next. No stated number is given. Manufacturers desiring to bid can obtain blank proposals and specifications by applying to general supply committee, this city.

NEW YORK CITY, Feb. 14.—The Diamond Rubber Co.'s New York branch has been moved from 225 West Fifty-seventh street to 1780-1782 Broadway, next door to the Goodrich Building.

Herreshoff Announces $500 Runabout

TROY, N. Y., Feb. 15—A $500 runabout has been announced by the Herreshoff Motor Sales Co. This car is featured by a handsome streamline body and is equipped with self-starter, generator, storage battery, top and windshield. The wheelbase is 90 inches, tread 44 inches and weight 750 pounds. Left drive and center control are used. The motor is a four-cylinder, L-head, block-cast construction with a bore and stroke of 2.375 by 3.75 and is rated at 16 horsepower. Thermo-syphon cooling is used and ignition is by the Atwater Kent system. From the motor the drive is taken by a cone clutch to a three-speed selective gearset and from thence by shaft to the rear wheels. One-quarter elliptic springs are used and the frame is a pressed steel design. The front axle is an I-beam forging, while a semi-floating axle is found in the rear. An irreversible worm and sector steering gear is used and a double set of brakes are fitted, both being of the expanding type. Exceptional economy is claimed for this car, it being stated that it is possible to obtain 40 miles to the gallon of gasoline. A speed of 50 miles an hour is possible on high gear. The equipment is complete, the cowl board contains speedometer, oil gauge, lighting and ignition switches and an electric light.

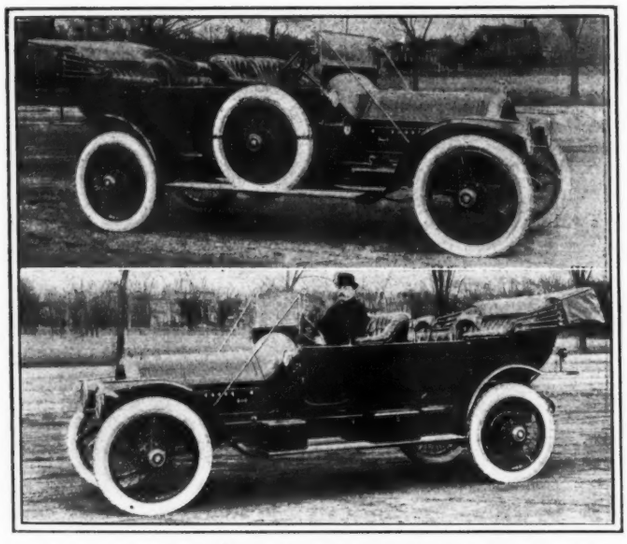
Goodyear Drops Policy Adjustments

AKRON, O., Feb. 16—The Goodyear Tire & Rubber Co. has announced that beginning with the first of the month it has curtailed its policy of tire adjustments in that adjustments are only being made where the tire trouble is due directly to faulty materials or workmanship and if a tire gives trouble at 2,000 miles or any other distance, an adjustment on the 3,500-mile distance will not be made if it is certain that the trouble was due to stone bruises or other causes resulting from careless driving. Under the new plan adjustments will only be made where the tire is at fault, instead of as in the past where policy adjustments have been widely made, namely, allowing for many adjustments, whether the trouble was due to careless driving or not.

The Goodyear company has formally taken over the manufacture and sale of Standard tire protectors as a part of its automobile tire department. This protector is a separate tire tread, which covers the side walls as well as the tread and when applied remains firmly in place without any fastening.

Motor and Accessory Elects New Members

NEW YORK CITY, Feb. 17—The following concerns have been elected to membership in the Motor and Accessory Manufacturers: the Michigan Steel Casting Co., manufacturer of steel castings, Detroit, Mich.; the New Haven Clock Co., manufacturer of clocks and watches for automobiles and motorcycles, New Haven, Conn., and the Standard Tool Co., manufacturer of twist drills, reamers, milling cutters, taps, chucks and small tools, Cleveland, O.



Two views of the new touring car to be made by the E. R. Thomas Motor Car Co. for 1914

Thomas Brings Out New Six-Cylinder

BUFFALO, N. Y., Feb. 14—The E. R. Thomas Motor Car Co., Buffalo, N. Y., has brought out a new model Thomas car for 1914. This is known as model MCX, and will be built in limited quantities to satisfy the requests of many Thomas owners. The chassis will be along the lines of the MC 1912 model, while the motor is the same as that used in the MX which is a six-cylinder type, 4.25 by 5.5 inches with the cylinders cast in pairs and developing 43.3 S. A. E. horsepower. The car will be built as a five or seven-passenger with a wheelbase of 134 inches. It will use Bosch high-tension magneto and Atwater Kent unisparker with battery. Wire wheel will be fitted as well as the Gray & Davis lighting system. The price will be $3,250 completely equipped.

Automobile Securities Quotations

More changes than usual occurred in this week's securities quotations. A few of the tire companies rose 10 or more points on their common stock. General Motors common rose 4 points, while New Departure experienced the largest rise of the week, that of 17 points on its preferred. Studebaker common dropped 2 points. Vacuum Oil rose to 214 at a gain of 4 points.

	1913 Bid	1913 Asked	1914 Bid	1914 Asked
Ajax-Grieb Rubber Co., com	165	180	200	..
Ajax-Grieb Rubber Co., pfd	95	100	99	102
Aluminum Castings, pfd	95	100	97	100
Chalmers Motor Company, com	..	..	85	90
Chalmers Motor Company, pfd	..	..	92	94
Firestone Tire & Rubber Co., com	225	240	270	276
Firestone Tire & Rubber Co., pfd	105	107	109	110½
Garford Company, pfd	106	108½	80	90
General Motors Company, com	30	32½	60⅜	64¾
General Motors Company, pfd	77	78	89½	90
B. F. Goodrich Company, com	42	43	23½	24
B. F. Goodrich Company, pfd	92	94	88	90
Goodyear Tire & Rubber Co., com	300	325	210	218
Goodyear Tire & Rubber Co., pfd	103½	105	96½	98
Gray & Davis Co., pfd	..	..	90	97
Hayes Manufacturing Company	..	90	..	..
International Motor Co., com	5	15	..	5
International Motor Co., pfd	40	60	..	15
Kelly-Springfield Tire Co., com	20	23	59	60
Kelly-Springfield Tire Co., pfd	80	87	120	130
Lozier Motor Company, com	..	..	12	..
Lozier Motor Company, pfd	..	..	..	65
Maxwell Motor Company, com	..	..	5	5½
Maxwell Motor Company, 1st pfd	..	..	27	27½
Maxwell Motor Company, 2nd pfd	..	..	8½	9
Miller Rubber Company	160	175	125	130
New Departure Mfg. Co., com	..	..	120	124
New Departure Mfg. Co., pfd	..	..	103	106
Packard Motor Company, pfd	103	105	94	98
Palmer & Singer, pfd	..	..	..	65
Peerless Motor Company, com	..	..	15	25
Peerless Motor Company, pfd	..	..	75	80
Pope Manufacturing Co., com	29	32	1	3
Pope Manufacturing Co., pfd	74	78	11	15
Portage Rubber Co., com	..	..	..	40
Portage Rubber Co., pfd	..	..	..	90
Reo Motor Truck Company	11½	12½	7½	8¼
Reo Motor Car Company	20½	21¼	17¾	18¼
Rubber Goods Mfg. Co., pfd	105	108	105	115
Splitdorf Electric Co., pfd	..	..	40	50
Stewart-Warner Speedometer Co., com	..	..	55	56
Stewart-Warren Speedometer Co., pfd	..	..	98	99½
Studebaker Company, com	31½	34½	26½	27⅛
Studebaker Company, pfd	91	93	84½	86½
Swinehart Tire Company	80	90	70	72
U. S. Rubber Co., com	62½	63½	59⅜	59¾
U. S. Rubber Co., 1st pfd	105½	106½	101¾	102
Vacuum Oil Co	..	..	214	218
White Company, pfd	103	107	105	110
Willys-Overland Co., com	68	69½	64	66
Willys-Overland Co., pfd	97	98¾	92	95

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Market Changes of the Week

Changes were scarce in this week's market reports. Tin dropped to $39.65 at a loss of $1.05. There was very little demand for tin in the local markets. Lead is dull and weaker. There was a very fluctuating market in this product last week. Starting at $4.15, it gradually dropped to $4.00 and then rose to the opening price. It closed on Tuesday at $4.00 at a loss of $.15 per 100 pounds. Cottonseed oil rose $.10 per barrel.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.06	.06	.06	.06	.06	.06	.....
Beams & Channels, 100 lbs.	1.36	1.36	1.36	1.36	1.36	1.36	.....
Bessemer Steel, ton	21.00	21.00	21.00	21.00	21.00	21.00	.....
Copper, Elec. lb.	.14 13/20	.14 13/20	.14 13/20	.14 13/20	.14 13/20	.14⅜	— .00 1/20
Copper, Lake, lb.	.14⅜	.14¾	.14¾	.14¾	.14¾	.14¾	+ .00⅛
Cottonseed Oil, bbl.	7.06	7.05	7.06	7.06	7.11	7.16	+ .10
Cyanide Potash, lb.	.17	.17	.17	.17	.17	.17	.....
Fish Oil, Menhaden, Brown	.40	.40	.40	.40	.40	.40	.....
Gasoline, Auto, bbl.	.16	.16	.16	.16	.16	.16	.....
Lard Oil, prime	.93	.93	.93	.93	.93	.93	.....
Lead, 100 lbs.	4.15	4.13	4.00	4.00	4.15	4.00	— .15
Linseed Oil	.52	.52	.52	.52	.52	.52	.....
Open-Hearth Steel, ton	21.00	21.00	21.00	21.00	21.00	21.00	.....
Petroleum, Kans., crude, bbl.	1.05	1.05	1.05	1.05	1.05	1.05	.....
Petroleum, bbl., Pa., crude	2.50	2.50	2.50	2.50	2.50	2.50	.....
Rapeseed Oil, refined	.59	.59	.59	.59	.59	.59	.....
Rubber, fine up-river, Para	.77	.78	.78	.78	.78	.77	.....
Silk, raw Italy	....	5.15	....	....	5.15	5.15	.....
Silk, raw Japan	....	4.30	....	....	4.33	4.33	+ .03
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb.	40.70	40.75	40.50	40.38	40.25	39.65	—1.05
Tire Scrap	.04½	.04½	.04½	.04½	.04½	.04½	.....

Cars Begin To Move in Trainloads

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Oakland Fills Three Trains—Buick and Westcott Make Big Shipments

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PONTIAC, MICH., Feb. 11—Three trainloads of Oakland cars to two dealers is the pace being set by the Oakland Motor Company for one day's business.

Announcement was made today of this record-breaking order which was obtained when F. H. Haller, President, and W. H. Head, secretary and treasurer, of the Lininger Implement Company, Omaha, who are Oakland distributors for Nebraska, visited the factory yesterday and conferred with President Geo. E. Daniels and General Sales Manager J. B. Eccleston.

One complete trainload of cars will leave the factory this month and another in March. The first train load is being rushed through at once.

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FLINT, MICH., Feb. 14—What is said to be the largest single shipment of automobiles consigned to one dealer that has ever been made east of the Mississippi river will be received shortly by the Leyman-Buick Company, distributors of Buick cars in Kentucky. The value of the consignment of machines, which total 176, is placed at $211,720, while the freight charges alone are over $3,000. The trainload of 61 freight cars will be shipped to Cincinnati, where the train will be broken up and several carloads left for distribution by the Cincinnati office. The rest will go to dealers in Kentucky, Southern Indiana and Southern Ohio. The Leyman concern maintains an office in Louisville and Cincinnati.

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RICHMOND, VA., Feb. 14—The Westcott Motor Car Company shipped, February 14, a train load of twenty touring cars to their Chicago representatives, Rowe, Young & Cooley.

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Motokart Incorporates—Plans to Expand

TARRYTOWN, N. Y., Feb. 18—Papers have been filed in Trenton covering the incorporation of The Motokart Co., which is to take over the Tarrytown Motor Car Co., Inc., and the Steinbock Engineering Co., Inc. The first named have for the past 6 months been exploiting the Motokart parcel delivery wagon for which the last-mentioned concern has furnished engines and other mechanical units. The new company will be capitalized at $500,000 and will at once push production upon a considerably increased scale.

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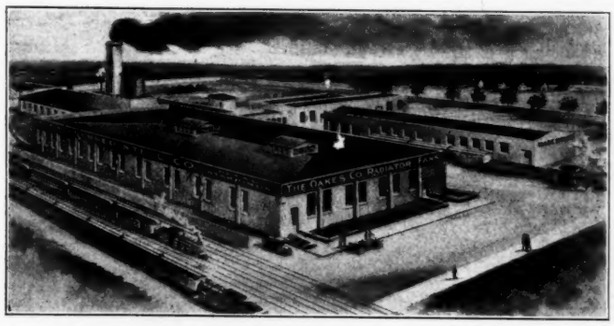
MENOMINEE, MICH., Feb. 14—The Dudley Tool Co., Menominee, Mich., manufacturing the Tideman cyclecar, has sold its entire 1914 output of 500 cars to a Chicago concern and its initial delivery, 100 cars, was shipped to Asia on the Chicago account last week.



New plant of the Oakes Pressed Steel Co., Indianapolis, Ind.

Oakes Pressed Steel Company Expands

INDIANAPOLIS, IND., Feb. 14—The Oakes Pressed Steel Co. of this city, has experienced such a growth of business that a new factory has been necessary and the company has now moved into its new plant at Division street and Vandalia Railroad. The company makes metal stampings of all descriptions.

French Grand Prix Has 39 Entries

Drivers Who Won Previous Grand Prix Contests To Compete

PARIS, Feb. 2—Thirty-nine racing automobiles, representing the pick of the European industry, were entered for the French Grand Prix, when the list closed last night, at ordinary fees. The race will be held on Saturday, July 4 on a 23-mile course near Lyons, and is open to cars having an engine of 274.6 cubic inches cylinder area and a maximum weight of 2,425 pounds empty.

The revived interest in this race has come as a surprise to the most optimistic, for it is not since the Dieppe Grand Prix of 1908 that such a fine set of cars has been got together for a European road race. This revival is due, in a large measure, to a realization on the part of manufacturers of the technical and commercial value of road racing, and also to the fact that the Automobile Club of France has selected a set of rules likely to give the greatest immediate benefit to participants.

With a cylinder area of 274.6 cubic inches, the average bore and stroke will be 95 by 160 mm. (3.7 by 6.2 inches). This corresponds exactly to the standard 18-horsepower models of several of the leading European firms; thus the racing cars will have a direct influence on the touring models.

There is a possibility of further entries being received, for the rules allow cars to be put in on payment of double fees until the end of March. It is known that Renault, Benz, Panhard and Humber have built 274 cubic inches racing motors, and even if they do not enter them for the race the tests will be carried completely through in order that these firms may have the same experience as those actually taking part in the race. Although all the cars are of high value, the real struggle will doubtless be between Peugeot, Delage, Sunbeam, Mercedes, and Fiat.

The list of drivers comprises all the winners of previous Grand Prix races. Felice Nazzaro, who is now driving a car built in his own factory, won the 1907 Grand Prix at Dieppe. Lautenschlager, head of the Mercedes team, captured the 1908 trophy, also at Dieppe. Boillot won the 1912 and the 1913 races at Dieppe and at Amiens, both on Peugeot machines. Victor Rigal, now on the Peugeot team, secured first place in the 3-litre section of the 1912 Grand Prix at Dieppe on a very fast course.

CARS AND DRIVERS IN 1914 FRENCH GRAND PRIX

FRANCE	
Peugeot	Georges Boillot
Peugeot	Jules Goux
Peugeot	Victor Rigal
Delage	Bablot
Delage	Albert Guyot
Delage	Rene Thomas
Th. Schneider	Champoiseau
Th. Schneider	Croquet
Th. Schneider	Gabriel
Alda	Tabuteau
Alda	
Alda	
GERMANY	
Mercedes	Lautenschlager
Mercedes	Pilette
Mercedes	Salzer
Mercedes	Nagel
Mercedes	Seiler
Opel	Joerns
Opel	
Opel	
ITALY	
Fiat	Louis Wagner
Fiat	Cagno
Fiat	
Nazzaro	Felice Nazzaro
Nazzaro	
Aquila-Italiana	Marsaglia
Aquila-Italiana	Beria d'Argentina
Aquila-Italiana	
Caezar	
ENGLAND	
Sunbeam	K. Lee Guinness
Sunbeam	Darius Resta
Sunbeam	Jean Chassagne
Vauxhall	Hancock
Vauxhall	
Vauxhall	
SWITZERLAND	
Piccard-Pictet	
Piccard-Pictet	
BELGIUM	
Nagant	
Nagant	

Many of Racing Cars Correspond to Stock Models in Dimensions

The road surfaces of the course are particularly good, for the whole of this district is of granite formation, giving a hard road on which steel studded tires make practically no impression. Although the roads are already better than the average in France, it has been decided by the government road department to make use of future credits and to spend $32,000 on the 23-mile course.

The Course in Detail

The course is a triangular one, 10 miles from Lyons, with trolley cars and trains running to 100 yards from the grandstands. No. 1 leg is level and slightly winding; No. 2 leg has a few slight gradients, but is cut on the flank of a mountain and has 75 distinct bends for a length of less than 8 miles. There is a pronounced hairpin turn with a sharp rise from No. 2 to No. 3 leg, and after climbing a 2-mile winding hill the drivers have a 9-mile straightaway without houses, trees, or cross roads, of a pronounced switchback nature. Drivers predict a speed of 110 miles an hour on portions of this leg. Just before striking No. 1 leg, and while directly opposite the grandstands, the road suddenly winds down hill, a certain point on No. 3 leg being only 300 yards from the grandstands on No. 1 leg. Spectators will only have to raise their heads to see the cars apparently making a bee line for them down the hillside. With the exception of a few yards on No. 1 hairpin turn, the racing cars will be visible to the grandstand spectators for a distance of almost 4 miles.

Minimum road width is 20 feet and maximum 52 feet. Twenty laps will be covered, giving a total distance of 467 miles.

With a big entry for its leading races now assured France is certain to be conspicuously in the public eye during the year, first, because of the fast racing cars that are being developed and also because of the array of famous drivers that are entered. But her glories are not all confined to French soil, at least her efforts are not, for it is now certain that three or four of her greatest drivers will ship cars to Indianapolis for the 500-mile speedway classic.

A 9-mile straightaway on the third leg of the Grand Prix course

80 m.p.h. Predicted at Santa Monica

LOS ANGELES, CAL., Feb. 17—*Special Telegram*—Better than 80 miles an hour in either the Vanderbilt or the Grand Prix is the prediction made by several of the leading drivers who have studied the Santa Monica course and who are looking for a new record in the meet of the Western Automobile Association, scheduled for Saturday and Monday.

The famous Santa Monica course is in the best of condition right now as was demonstrated today when Tetzlaff in his Fiat made a lap at the rate of 87 miles an hour.

The Mercers and Stutzes slipped around almost as fast and the English Sunbeam is reported to have put up sensational figures. Altogether it looks like a big revival of the American classics.

Of the sixteen entries in the Vanderbilt and eighteen in the Grand Prix it looks as if every one of them will start. The only doubtful one is the French Delage, which is expected here tomorrow morning. Bert Dingley will pilot the Delage in place of Omer Toft, who was injured driving it in France. The placing of Dingley behind the wheel of the Delage makes that car one of the favorites.

The only other change is the substitution of Rickenbacher in a Mason in the Grand Prix in place of Dave Lewis, who was injured in practice Monday. Lewis, driving a Fiat, went into the crowd at Soldier's Home killing an old soldier and injuring several of the spectators. A broken steering knuckle, caused by crystallization, was the cause of the accident. Lewis and his mechanic were sent to the hospital but both will recover. The mishap has caused the officials to redouble their efforts to safeguard both the course and the drivers.

One of the stories afloat tonight, is that several disgruntled residents of Santa Monica are talking of securing an injunction restraining the meet promoters from collecting tickets because they have not been favored with passes, but inasmuch as the Santa Monica Chamber of Commerce is co-operating with the promoter in the promotion of the meet no trouble is anticipated.

A change in the officials has been made. Fred J. Wagner will start the Vanderbilt and on Monday will serve as referee of the Grand Prix in order that George Adair, one of the most prominent race officials on the Coast, may handle the checkered flag.

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Boillot and Goux Enter 500-Mile Race

INDIANAPOLIS, IND., Feb. 17—*Special Telegram*—The Speedway management today received five formal foreign entries, making the total number of entries to date for the 500-mile race to be given Memorial Day, eleven. The entries were from Boillot and Goux, who will drive Peugeot cars, Guyot in a Delage, Christaens in a Belgian Excelsior and Chassagne in a Sunbeam.

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A. A. A. Contest Board Ratifies Records

NEW YORK CITY, Feb. 11—The first meeting of the Contest Board of the American Automobile Association, under the chairmanship of R. Kennerdell was held today. Two new records were recognized, the 200-mile mark of Ralph Mulford in a Mason made at Columbus, O., on a mile-track on July 4, 1913, was allowed; the time being 3:21:48. The previous record was held by Earl Cooper in a Stutz and was 3:27:23, made at Fresno, Cal., February 10, 1913. The other record allowed was 50 miles by Louis Disbrow in a Simplex at Detroit, September 29, 1912, Disbrow's time was 45:32, and replaces the previous record of 47:21:65 held by DePalma in a Simplex, and made at Syracuse, N. Y., September 16, 1911.

The Board received a communication from the Cyclecar Manufacturers National Association notifying it of the desire of the cyclecar makers to operate under A. A. A. sanction. The board is already busy on formulating cyclecar rules with the expectation of an influx of applications for sanctions of events arranged for the little machines.

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Proposed Tax Increase Disturbing Belgians

BRUSSELS, BELGIUM, Feb. 10—Belgian automobile manufacturers have been in a disturbed condition for the past 2 months by reason of the proposed increase of taxes on automobiles. During the past there has been little uniformity in the method of taxing cars, and in some of the provinces local taxes only were paid, nothing whatever going to the central government. Under the new regulations, which have finally been accepted by all parties, taxation will be paid to the central government on a horsepower basis, and in addition local taxes will have to be paid in certain provinces, but these local taxes can never exceed a certain proportion of the government taxes. The formula on which the horsepower is determined is the following:

$$H.P. = K\ (d^2 \times c \times n \times N)$$

in which $K = 4.25$, d is the cylinder bore in meters, c the stroke, n the revolutions per minute (these will always be considered 1000), and N the number of cylinders.

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E. V. A. Slates Tire Meeting for Feb. 24

NEW YORK CITY, Feb. 17—The Electric Vehicle Assn. of America has slated a tire meeting for February 24, to be held at the Engineering Societies Bldg., 29 West Thirty-ninth street, this city. F. E. Whitney, chief engineer of the Commercial Truck Co., Philadelphia, Pa., will give the manufacturers' side of the question in a paper on "Electric Commercial Vehicle Tires."

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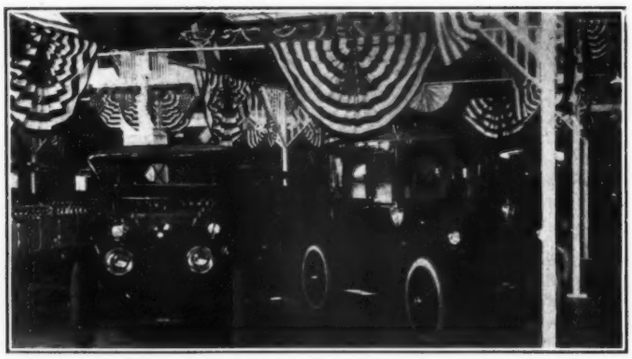
Empire Electrical Equipment

INDIANAPOLIS, IND., Feb. 17—The new series Model 31 Empire, manufactured by the Empire Automobile Co., of this city, is using as standard magneto equipment the Eisemann high-tension independent magneto, with set spark on all cars. Where starting and lighting equipment is specified the Remy starting and lighting system is used, together with the Eisemann high-tension independent magneto.

Grand Prix course—Left—Winding road on second leg of circuit. Right—Sharp turn at entrance to second leg.



One corner of Bloomington, Ill., automobile show

Many Motors Shown at Pittsburgh

Bloomington Dealers Organize —Grand Rapids Sells 300 Cars

PITTSBURGH, PA., Feb. 16—Trucks compete with pleasure cars at the fourth annual Pittsburgh show and the test of exhibition popularity so far gives the automobile only a slight advantage.

So educated are Pittsburgh folk to the importance of machinery—industrial or otherwise—that displays of engines are attracting unusual throngs. It was remarked that the interest of the average show visitor in the working of a mounted motor car engine is extraordinary.

The show which opened in the Exposition building at the Point last Saturday will stand out as being representative of many well-known lines in the automobile business. Aside from the automobile exhibit running from the immense touring cars down to a small two-passenger runabout there was a splendid exhibition of electric cars, much the finest ever seen in the city. In commercial vehicles Pittsburgh has never seen such a variety of standard makes, especially among the heavy trucks as is on exhibition this week. The accessory exhibits are arranged as usual around the gallery and added much to the credit of the show. The famous Nirellas Fourteenth Regiment Band will furnish music the entire week. Several notable exhibits which are new are those of the East Liberty Branch, Y. M. C. A. School for Autoists which is being largely attended this winter. Many factory representatives are here for the purpose of establishing new agencies and sizing up from this show the prospects for business this year.

Thursday night will be society night.

The number of passenger cars is 110 and their estimated cost is $150,000. There are twenty-five trucks on exhibition costing $50,000. The range of prices of the cars on exhibition is from $450 to $5,000, while the trucks range from $1,000 to $3,500 each.

Among the new exhibits of this show this year are the Imp, Morse and Mercury cyclecars.

One of the most striking exhibits in the show is the automobile fire insurance exhibit of the Queen Motor Fire Insurance Co., of which Hoover & Hurst of this city are agents. A mammoth touring car which had passed through a vicious fire and had been stripped of every particle of wood is shown with bearings twisted and melted by the heat. The car, which was seen on Pittsburgh streets last week, bears a sign advertising the fact that the insurance was settled within 3 days of the fire.

Dealers Organize at Bloomington Show

BLOOMINGTON, ILL., Feb. 14—Although there are only two more exhibitors at the fourth annual Bloomington automobile show than the number that made displays in 1913, the exhibition is much larger from the standpoint of the vigor of the trade.

Three large new garages in the city, all of construction during the last six months, are more indicative of the substantially stimulated business.

Agents of cars and dealers in accessories outside of Bloomington were refused display space, as the local trade insisted on monopolizing the show.

While the show is promoted and is being conducted by the Bloomington Automobile Club and has always been a business and harmonious success, it is now thought best that the dealers and garage owners organize and this will be the rule of business for the last day of the show, Feb. 21.

The exhibition opens Feb. 18 at the Deere building and concludes Feb. 21. Sixty cars will be on exhibition together with numerous lines of accessories, etc. Every inch of space was contracted for six weeks prior to the opening.

Club Transacts Show Business

The club assumes all expenses, collects the receipts, and the excess of receipts over expenses is turned back to the dealers, proportionate to the sum they paid for space. In the preceding years, the rebate has been considerable, making the expense to each dealer very small in comparison to the results achieved.

The dealers have in the past been content to permit the club to adjust various propositions which ordinarily would be settled by the dealers themselves. It has been decided, however, to organize a Bloomington dealers and garage proprietors association.

This association is regarded as important in establishing credit among patrons and to remedy various evils which have been increasing with the growth of the industry. Uniformity in prices and sales agreements will also be promoted by this association, while it will look after other matters affecting the welfare and prosperity of the membership. The association of dealers will co-operate with the McLean county motor club, where its services are desired. An effort will be made to check the evil of price cutting and also to promote legitimate methods of doing business.

Bloomington has two firms doing a wholesale as well as a retail business, J. L. Murray & Co., and C. U. Williams & Son. These two firms rank with the largest in the state outside of Chicago. The first firm handled the Overland and National lines last year and distributed 175 cars.

The firm of C. U. Williams & Son handled the Studebaker and Chalmers gasoline cars and Woods electric last year. This year the Saxon and the Overland have been added, 200 of the latter being contracted for during 1914. Last year this firm distributed 275 cars. It is believed that this business will be exceeded fully 25 per cent. this year. The Ford agency, which is in charge of Floyd Izeminger, distributed 265 of these cars last season.

There are twenty dealers in automobiles in Bloomington, of whom four carry trucks and three carry electrics. There are twelve garages and three supply houses while a number of the garages, carry a large line of supplies. During the past year, the Bloomington dealers sold 800 cars. Orders taken by the Bloomington dealers so far this year aggregate fifty. The favorites are the cars that sell for $1,000 to $1,200. Those who are willing to go above the latter figure, usually buy the $2,000 type. Three-fourths of the cars sold in central Illinois have been at $1,000 or less. The other fourth have ranged from $1,200 up to $2,000. With the exception of the electrics, not to exceed two cars were sold in the Bloomington territory last year costing over $2,000.

Crops are an all important factor in car selling in central Illinois. Crop failures are extremely rare and this has resulted in farmers living up to their income rather closely, anticipating large yields. Last year there was a marked shortage in the oats and corn crop and much of the paper issued to cover car purchases could not be cashed last fall. This resulted in a general renewal of notes. The currency agitation and general business depression of the past 6 months also had some effect upon fall and winter business. This appears to have all disappeared in this territory and dealers are looking forward to a prosperous year, contingent that the crops are up to the average.

Grand Rapids Sells 300 Cars Retail

GRAND RAPIDS, MICH., Feb. 14—Direct retail sales that will nearly total 300 cars resulted "off the floor" of the automobile show promoted by the *Grand Rapids Herald* which ended tonight.

Dealers, many of them with convoys of eager prospects, flooded the exhibition during the 6 days and their orders evince the highest note of optimism. It was the fifth yearly show.

Despite the prevalence of below zero weather on 5 of the 6 days the attendance, approximating 30,000 people for the week, set a record for any sort of indoor attraction in Grand Rapids during a similar period. Probably one-third of the visitors was from west Michigan territory tributary to Grand Rapids, and the heavy percentage of the sales to ultimate consumers was to out-of-town buyers. Sub-agents, many of whom thus far this season have striven under the handicap of having no demonstrating cars, or of being unable to use them on account of the heavy going, convoyed their prospects here in sizeable delegations, and closed with a fair proportion of them.

The aggregate volume of sales, it is unanimously conceded, will attain to tremendous figures. There was noticeable a strong trend toward the acquisition of closed cars, and more of the

gasoline type than of the electric, although the latter were by no means overlooked. The weather probably was a potent stimulant to such sales.

In the accessories section, business was tremendous. One tire agency not in the prescribed circle reported taking orders for over $14,000 worth of tires.

Those dealers who did not figure most largely in the daily report of sales expressed as much satisfaction as the others, all figuring that they have advanced impending sales by from 1 to 2 months.

Thirty exhibitors of gasoline pleasure cars displayed seventy-one models of that type of vehicle, eight electric carriages were shown, seventeen trucks and fourteen stripped chassis. Not one of the cars shown on the floors will be returned to the factory.

The closing day was notable for the number of dignitaries who graced the event by their attendance. Among those present Saturday were, Senator William Alden Smith and his party of Lincoln Day banquet guests from Washington, which included ex-Speaker Joseph G. Cannon and others.

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Crowds at Second St. Louis Show

ST. LOUIS, MO., Feb. 14—St. Louis' spring automobile show, the exhibition of the "exiled" dealers, is a great success. With all the floorspace sold to dealers from all parts of the country, the show is attracting as much attention as did the fall show last October.

The pleasure cars exhibited are: Electrics—Argo, Borland and Broc. Gasoline cars—Imperial, Speedwell, Vulcan, Cartercar, Pathfinder, Maxwell, Havers Six, Haynes, Richmond Six, and Westcott. Commercial Vehicles—Speedwell, Mogul, Little Giant, Republic, Palmer Menomonee.

Twenty-five accessory dealers are exhibiting, among them dealers and manufacturers from all parts of the country.

One of the most interesting exhibits in the accessory line is that of the St. Louis firm, Genoni and Marcena, who are showing their new signal device. This is a long rod with a light and red flag at each end which may be attached either to the front or back of the car. When turning a corner the driver may signal his plans by pressing a button, which by day releases a small red flag on the side toward which he is turning and at night flashes a little red light in the same manner.

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Over 10,000 at Twin Cities' Show

MARINETTE, WIS.—The first motor show ever held for the benefit of residents of the twin cities, Marinette, Wis., and Menominee, Mich., and the neighboring counties, was that conducted in the Marinette Armory by the Twin City Automobile Dealers' Association on February 12, 13 and 14. Thirty-two makes were represented in the car exhibits and the attendance record showed that nearly 10,000 persons visited the exposition, guaranteeing a continuance of the shows in the twin cities in coming years.

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Newark Show Has Thirty-seven Exhibitors

NEWARK, N. J., Feb. 16—There will be thirty-seven exhibitors at the automobile show which will open on Feb. 21. Twenty-five of these will be passenger car exhibits and the rest will be commercial. The show, which will be held in the First Regiment Armory, will show no display of cars or accessories in the balcony. Everything will be on the ground floor.

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Reception Opens New Cole Home

ST. LOUIS, MO., Feb. 14—The new Cole home, the handsomest and most modern of Western automobile houses, was opened at 1419 Locust street last night. The building is a three-story concrete structure of the latest type.

John J. Cole president of the Cole Company, Indianapolis, and Homer McKee were present.

After a reception, President Gottshal of the local company announced that C. Gratiot Cabanne, pioneer St. Louis automobile man and scion of the city's oldest family, would be sales manager. Cabanne formerly was manager of the local Oldsmobile agency.

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Hess-Bright Gets Packard Contract

DETROIT, MICH., Feb. 16—For the first time in its history the Packard company has placed its entire contract for annular ball bearings with one concern for a period of one year from February 1, the Hess-Bright Mfg. Co., having secured the order.

30,000 Attend Show at Louisville

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Kentucky To Take 5,000 Cars —Car Under $1,000 Sells Best

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LOUISVILLE, KY., Feb. 14—Kentucky cheer was properly in evidence at the seventh annual exhibition of the Louisville Automobile Dealers' Assn., which closed tonight. From the trade tone of the show, the exhibitors declare that 5,000 cars will easily find a market in the Bluegrass state in 1914—a gain of 1,500—that the car under $1,000 is the Kentucky best seller, and that the electric vehicle sale is "perking up" in the larger cities, especially Louisville.

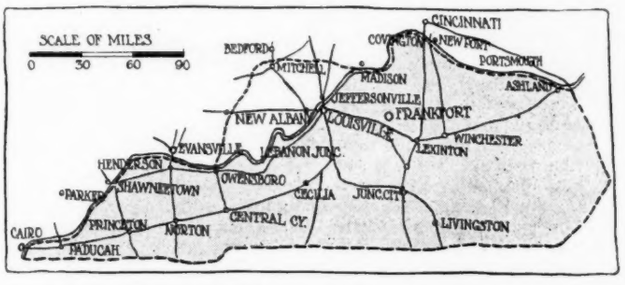
A record-breaking attendance and an unprecedented number of sales unquestionably made it the biggest and most successful show ever held in Dixie. It was the initial display to be staged this year south of the Ohio river and, despite adverse weather conditions, 30,000 persons attended. The attendance figures of last year were surpassed by 5,000.

During the show, Louisville was held in the grasp of the worst blizzard of the winter. It started on the morning following the opening of the exhibition. By Friday, street car service was paralyzed, trolley wires were down and the streets were blocked with snow and ice. Going was difficult even for automobiles. The city was covered to a depth of 12 inches of snow, the record of 4 years. The show held attention for four nights and three days, beginning Wednesday.

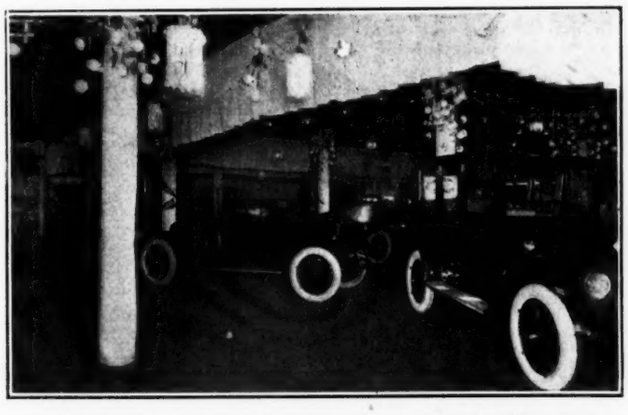
The 54,000 square feet of floor space, afforded in the mammoth drill hall of the Armory, make it one of the leading show places of its kind in the country, there being no pillars to obstruct the view.

Forty exhibitors were represented. In 1913, only thirty-eight concerns were listed. The total value of the exhibits, including pleasure cars, trucks, motorcycles and automobile accessories is placed at $500,000. Each make of machine was shown in from one to seven different models, aggregating about 140 cars. Practically every make of gasoline car and electric handled in Louisville was represented at the Armory. The cars ranged in price from a $5,200 Pierce-Arrow to a $475 Metz.

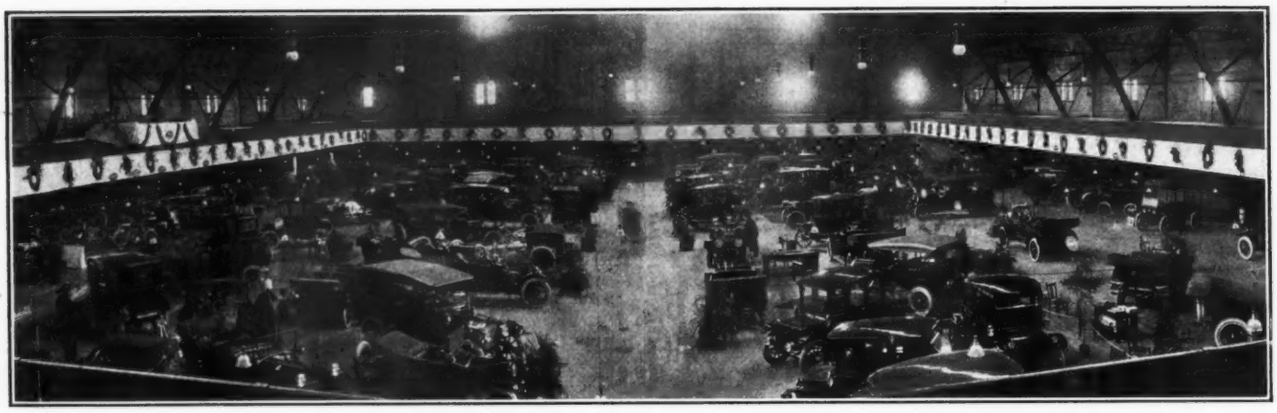
Every one of the exhibitors expressed himself as more than pleased with the results. Fully 150 cars were sold, one dealer



Map of territory served by Louisville automobile dealers



An entrance to the exhibit rooms at the Grand Rapids show



Panoramic view of the seventh annual automobile show held in Louisville, Ky., in the First Regiment Armory

alone reporting the sale of fifty-one. Many new contracts were made with sub-agents out in the state and a great deal of new territory was opened up as a result of the 1914 exhibition. At least 300 dealers, sub-agents, and tire men from Southern Indiana, Eastern Tennessee, Kentucky and the western sections of the Virginias attended the show.

Louisville is an automobile city, not in the producing sense, but from the standpoint of use and distribution. As a distributing point, with excellent railroad facilities, it ranks with the leaders. Some of the largest automobile factories and tire concerns in the United States maintain branches here.

Only one pleasure car, the Ames, is made in this state, and this machine is built at Owensboro, Ky. Three firms in Louisville are engaged in the manufacture of trucks. They are the Kentucky Wagon Mfg. Co., Urban electric; the Transit Motor Car Co., Transit, and Longest Bros., Longest truck. The Urban has the largest distribution. Louisville boasts of the only tire factory in the South. This is the Ten Broeck Tyre Co., makers of Ten Broeck tires, which have a wide market in the Southern states.

The district embraced by Louisville agents, factory representatives and branches, as a rule covers southern Indiana and the entire State of Kentucky, and in one instance the eastern portion of Tennessee, West Virginia and the extreme western section of West Virginia.

Optimism is in evidence everywhere and indications point to a splendid season following the show. Business is much better than it was this time last year. A conservative estimate based on interviews with dealers would be an increase of about 25 per cent. in the sales during the first five weeks of 1914 over the same period in 1913. A few dealers and factory representatives say business is 50 per cent. better, while many declare they have sold twice as many, but this is the exception rather than the rule.

Local distributors at present are doing the bulk of their business out in the state, the Bluegrass and Southern sections proving the most profitable fields. The tobacco crops and weather conditions have a great influence on the sale of motor cars. During the past few months no complaint can be made about the weather and the farmers are receiving a higher price for their tobacco than ever before.

Mild weather and moist atmosphere during the greater part of the last 2 months have favored the preparation of the weed for market in a way unequaled in years, prices have been relatively high and generally satisfactory to producers and as a result of this combination of factors, the crop is being marketed with unusual rapidity. Kentucky's area planted in tobacco last year was 370,000 acres. The average price per pound advanced last year from 8.7 cents to 10 cents per pound and the value of the 1912 crop is estimated at $28,120,000 as against $29,926,000. It is some of this money which will be used in the purchase of 1914 automobiles.

Kentucky maintains her lead over all other states in the volume of tobacco raised, her 1913 production of 281,200,000 pounds comparing with 167,500,000 pounds raised in North Carolina, the nearest competitor. Already preparations are being made by the growers for the 1914 crop, and it is possible that there will be a material increase in the acreage. This conclusion has been drawn from the lively demand for seed from the warehouses.

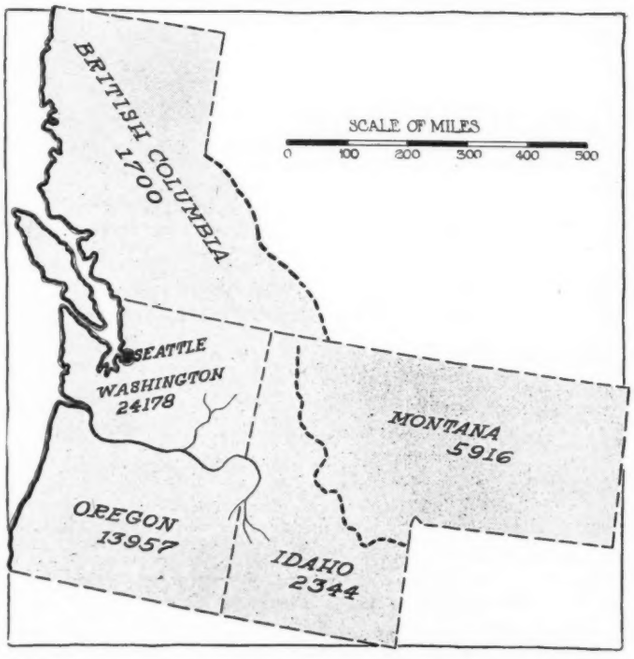
Owing to the tendency of some of the dealers to keep their sales secret and the fact that it is impossible to ascertain the information from the state licenses, because of the method used in registering machines, no accurate figures of the number of cars sold in 1913 can be given. Those in close touch with the situation estimate that 3,500 automobiles were placed in this territory during the past year.

Distributors of a car listed under $1,000, which has proved the best seller in Kentucky, predict the sale of 2,800 machines of this make in 1914. A representative of the Leyman Motor Co., who has just returned from a tour of the state, declares his concern will place 500 Buicks in Kentucky during the coming year. That there will be 400 new Overland owners is the belief of the agent for this particular make. On this basis and considering the estimates of other dealers, it is believed that 5,000 would be a conservative figure for the number of automobiles that will be sold in the Bluegrass state in 1914.

The farmers—the majority of them—want a car selling in the neighborhood of $1,000 and they prefer a touring car, though there is a demand for the runabout. The car listed at $800 and under finds a ready market south of the Ohio river, provided it has a reliable and well-known company behind it.

Agents for electric vehicles report that business is excellent. The sale of this type of car is confined to the larger cities, Louisville being the chief market. Conditions in this city are very favorable to the operation of electrics. The streets are generally level, having an average grade on hills of 1 per cent. and a maximum of 14 per cent. Louisville has 60 miles of asphalt pavement, 56 miles of macadam, 70 miles of brick and 20 miles of granite.

Kentucky merchants and manufacturers are fast realizing the value of the commercial vehicle, especially as time savers. The



Map of the territory served by the automobile dealers of Seattle

biggest demand at present seems to be for a light delivery car. However, there is a good market for the heavy truck, although some of the big whisky and brewery concerns have not yet adopted them.

Kentucky with its 2,289,905 population, offers a big and practically undeveloped field for the automobile manufacturer, as there are only about 10,000 machines within its limits, 2,400 of these are owned here in Louisville. To judge from the optimistic predictions of those connected with the industry the state is just waking up to the value of the automobile and its advantages over the horse. The roads in the central part of the state, known the world over as the famous Bluegrass section, cannot be surpassed anywhere. In other parts of the Commonwealth the highways as a rule are better than those of other Southern states.

The Louisville Automobile Dealers, under whose auspices seven motor exhibitions have been held in Louisville, came into existence in 1903, and has among its members the leading and oldest firms in the trade.

As usual, the local branch of the Ford Motor Co. conducted a private show at their salesroom on Motor Row during the Dealers' Exhibition at the Armory.

Boston Show to Be America's Largest?

BOSTON, MASS., Feb. 16—Manager Chester I. Campbell, of the Boston Motor Show, states that space has now been sold to eighty-five makers of pleasure motor vehicles, which will make the Boston exhibition a larger one than either New York or Chicago where there were seventy-eight and eighty makes shown respectively. Additional applications are on file and may be crowded in. The plans are all in shape and the decorations have been on hand for some time waiting for the word to be set up. An army of 500 men has been signed to look after the preliminaries. All the dealers are ready to move in now.

Practically all the space in the accessory section has been sold and despite the fact that the accessory association put the ban on Boston there will be no lack of exhibitors in this department.

That there will be a big crowd on hand is shown by the fact that most of the hotels are now booked to capacity. And applications for more than 2,500 dealers' cards have been sent in to Mr. Campbell.

The plans for the truck show are making headway and about all the space for the main floor has been allotted. This will open Tuesday, March 17, and continue until Saturday, March 21.

Optimism Opens Kansas City Show

KANSAS CITY, MO., Feb. 16—*Special Telegram*—The 1913 attendance of 40,000 is a mark certain of defeat this week at the million-dollar show that opened in Convention Hall yesterday afternoon. Five hundred cars are on display in a setting that represents an English garden. The dealers, at the opening of the usually arduous show week, are smiling at the promise of big business. Judging by the advance 1914 orders, they say, the sales that will result from the show will make the year a record one for the automobile trade in the Southwest.

A District Show for Fall River

FALL RIVER, MASS., Feb. 16—The biggest motor show in Southeastern Massachusetts will open next Monday in the regimental armory here, when dealers from Fall River, New Bedford, Providence, Taunton, Woonsocket, Attleboro and several other cities will display cars. The show will continue a week.

Parade and Publicity for New Haven

NEW HAVEN, CONN., Feb. 10—An "automobile week" instead of a show is the trade exploitation plan of the automobile dealers of New Haven. The last week in March is the one chosen for a special program.

Seattle Will Require 10,000 Cars for 1914

SEATTLE, WASH., Feb. 9—The Northwest, that ordinarily germinates blizzards at this time of the year, now beams with torrid sunshine on the motor car industry.

Seattle, during its second annual automobile show, announces that the territory it serves will require just about 10,000 cars during 1914, which is 5,000 more than were placed in the blizzard birth region in 1913.

A trade gain of 100 per cent., in spite of the gloom that has thickened the frowns of the Atlantic coast, will be received with more éclat at automobile manufacturing centers than the mildest of blizzards.

Fifty-five pleasure and commercial vehicles and accessory displays arranged by the twenty-nine dealers worth more than $100,000, are on exhibition at the show, which will be in progress throughout the week.

Gasoline pleasure cars displayed include: Buick, Cartercar, Chalmers, Chandler, Chevrolet, Cole, Ford, Franklin, Havers, Haynes, Hudson, King, Kissel-Kar, Marmon, Metz, Mitchell, Oakland, Oldsmobile, Overland, Pullman, Stevens-Duryea, Studebaker and Stutz. One electric, the Detroit, is represented. Six makes of commercial motor vehicles are being shown, the list including Federal, Garford, Kelly, Kissel-Kar, Menominee, Standard and Willys.

In every respect, the 1914 show eclipses the successful undertaking of last year. Widespread interest has been created in this week's exhibition and it is estimated that not less than 25,000 persons will attend. Dealers from all parts of the Pacific Northwest will gather here during show week, the number of dealer visitors being at between 600 and 700. William I. Fitzgerald, manager of the show, sent out 1,000 invitations and more than one-half of the recipients have written that they will attend the affair.

Seattle, geographically in the heart of the Northwestern states, has just finished a year of business that shatters all previous marks. Figures based on information supplied by the forty-nine dealers and distributors who are engaged in the motor business in Seattle show that more than 5,000 machines were handled through this city during the year of 1913, which number represents a volume of $7,500,000, using an average of $1,500 a car as a basis. About 200 trucks were sold out of Seattle in that period.

Out of this tremendous trade, the Ford car emerged the leader, a total of 4,047 machines of that make having been handled by the local branch, which distributes to the territory embracing all of the states of Washington, Idaho and Western Montana and several counties in Oregon. Buick, Overland, Studebaker and Metz proved close competitors for the leadership. While the demand for the low-priced types showed the greatest life, study of the sales sheets discloses increased popularity of the cars ranging in the $2,000 field, in which the Cadillac assumed the command. Oakland, Chalmers, Hudson were close up, with the Stutz, Franklin, Cole and Havers well up. The demand for high grade cars has maintained a steady pace and there appears to be no falling off in the call for them.

Practically every dealer handling cars ranging from the cheapest to the most expensive, expects to double his 1913 allotment. Improvement in general business conditions has brought with it a strengthened demand for automobiles, particularly in the lumbering sections of the Pacific Northwest.

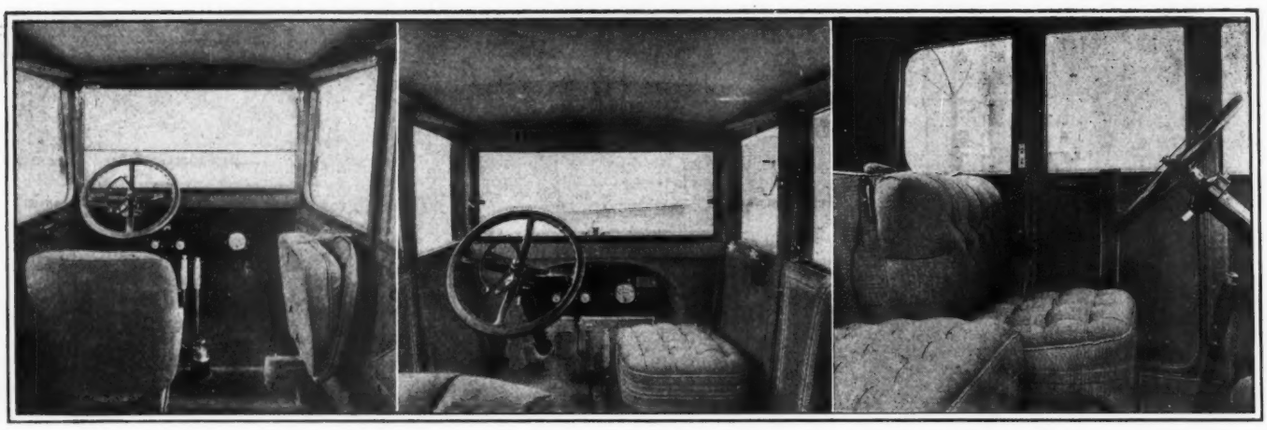
Seattle dealers distribute to the entire state of Washington, Oregon, Montana and the Canadian provinces of British Columbia and Alberta. Of the forty-nine automobile agencies here, seven are factory branches. There are twenty supply and accessory stores, thirty-three repair shops, exclusive of the agency service departments, sixteen tire agencies and branches and twenty-five public garages.

Forty-nine makes of passenger cars are represented in Seattle, and there are thirty-three kinds of trucks, making a total of eighty-one different makes.

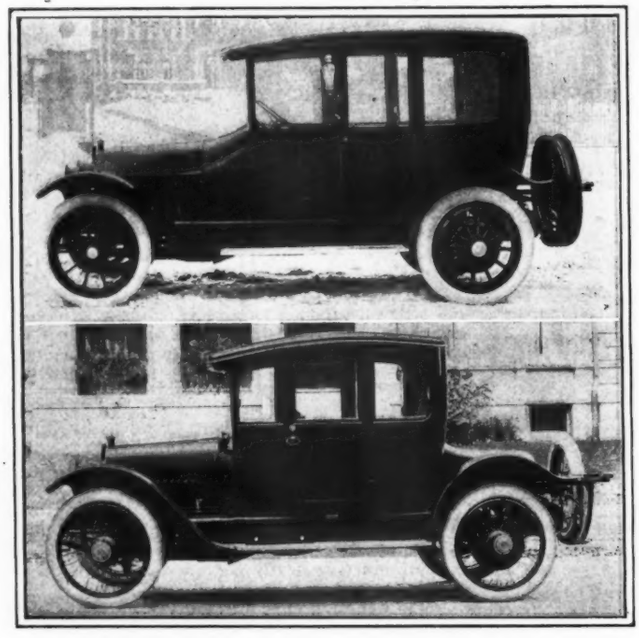
Washington, Oregon, Idaho, Montana and the Canadian provinces of British Columbia and Alberta possess a variety of industries that practically preclude the possibility of "slumps" in business. Among the section's industries are fishing, lumbering, mining, shipping, fruit and grain growing and dairying.

Seattle has a population of about 300,000 and boasts of 6,000 automobiles, of which about 500 are motor trucks and motor delivery cars. In the last 18 months the commercial vehicles have made rapid progress; and the pleasure cars have increased steadily. Seattle's industrial possessions as affecting the automobile business consist of a five-story Ford assembling plant, which will begin operations in March and will have an annual capacity of 7,000 machines; several tire building and rubber manufacturing establishments; and a cyclecar factory, which is now being equipped and will start making cars within 30 days.

The cyclecar has just made its appearance in Seattle, and its reception indicates that there is a demand for such a type of motor vehicle.



Left—Stearns-Knight sedan, showing folding seat. Center—Coupé, showing auxiliary seat. Right—Coupé. Note staggered seats



Upper—New Stearns-Knight sedan. Lower—Four-cylinder coupé fitted with wire wheels

Stearns Adds Coupé and Sedan Bodies

CLEVELAND. O., Feb. 14—The F. B. Stearns Co., Cleveland, O., has enlarged its line of closed cars by the addition of coupé and sedan bodies. This is the first time new closed bodies have been added.

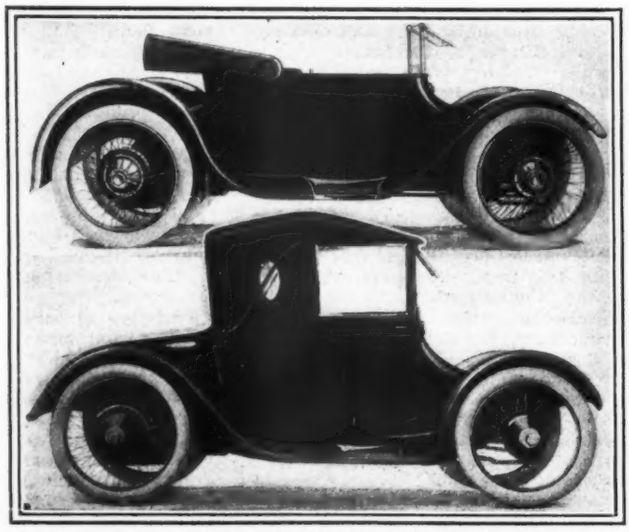
This year the line was made complete by the addition of the new four- and six-passenger touring cars in the open type, and coupé and sedan models in the closed type. Altogether, nine bodies are furnished on either four- or six-cylinder chassis—a total of eighteen models.

The coupé and sedan models carry the same sloping hood and cowl that distinguish all Stearns-Knight models this year. The coupé is set well forward on the frame, leaving a graceful deck in the rear beneath which is a commodious storage compartment.

The staggered-seat construction of the coupé serves to place the driver well forward. This construction also gives space for another storage compartment back of the driver's seat. The seat in the front of the body may be folded up out of the way when not in use.

The sedan shows an entirely different type of interior construction, as the body itself is longer than that of the coupé, and seats five passengers. All seats face forward, one seat folding up against the side of the car when not in use.

The prices of coupé and sedan bodies for either the four- or six-cylinder chassis are, respectively, $1,200 and $1,750. The prices including chassis are: Coupé, four-cylinder chassis, $4,450; six-cylinder, $5,550; sedan, four-cylinder, $5,000; six, $6,100.



Upper—Electric roadster which the Columbia Electric Vehicle Co., Detroit, Mich., proposes to make for $785. Lower—Coupelette to be made for $985

To Make Electrics Under $1,000

DETROIT, MICH., Feb. 14—The Columbia Electric Vehicle Co. has been formed in Detroit with the purpose of manufacturing electrics at popular prices. Three types of bodies will be fitted to the same chassis, namely, runabout to sell at $785 and a coupelette at $985.

The concern has not gone very far with its manufacturing plans and is not yet ready to make any announcement of the men back of the enterprise, although it is said that certain ones well known in the trade and identified with previous successes are behind the venture. The offices are in the Dime Savings Bank Building.

The illustrations herewith give the general outward appearance of the three types which the Columbia organization proposes to make. The chassis has a wheelbase of 96 inches, is low hung and has straight-line shaft drive back from the motor to a worm gear rear axle. Spring suspension is of cantilever type.

Battery equipment is to be of Willard make, the cells having eleven plates. The runabout will carry twenty-six cells and the coupelette twenty-eight. Tires will be pneumatics, 31, 32 and 33 by 4 respectively. The speed given is about 20 miles an hour.

It is the intention to equip both roadster and coupelette with wire wheels. The bodies are to be made of steel and depart considerably from conventional electric vehicle design. The roadster has novel fenders which have a graceful sweep and lend much the general appearance of the design.

The coupelette has a combination open and closed body, which type is adaptable to any kind of weather.

WORKING on New Morrow Plant—Ground was broken in Elmira, N. Y., for the new building to be constructed at the Morrow Mfg. Co.'s plant on the Southside. The new building will be erected on Scott street, extending from the present Morrow factory back to South Main street. The northern section of the old Payne building will be razed to make way for the new building. The new building will be completed by June 1, officials of the Morrow plant believe. When finished the new Morrow addition will have a plant consisting of 9 acres inclosed under roof. Five hundred additional workmen will be employed when the Morrow addition is completed and within the next 6 or 8 months 2,500 additional men will be employed in the annex.

Service Dept. at Moon Plant—The Moon Motor Car Co., St. Louis, Mo., has established a complete service department at the company factory. The company will keep a staff of expert mechanics at the shop day and night and these will be rushed to any point within a radius of fifty miles of St. Louis.

Overland's New Toledo Bldg.—George S. Mills has prepared plans and will award contracts during the present month for a new building planned by the Willys-Overland Co., to be erected at the plant on Central Avenue. Toledo, O. It will be 410 feet long, 200 feet wide, two stories high, of concrete and brick, and used for the construction of auto bodies. It will cost $150,000 an dis one of the first of a series of large extensions that will be made at the plant during the coming summer.

Parish Building Contracts Awarded—The Parish & Bingham Co., manufacturer of cold-pressed steel stampings, has awarded contracts on the erection of a new building at Madison avenue and West 106th street, Cleveland, O. The structure will be 90 by 100 feet and will be one story high. The building will cost $180,000. Eight and one-half acres of land have been purchased. In its present quarters on Hamilton avenue the company is exceedingly cramped for room. Over 1,500 auto frames a day are being shipped to the Ford plant in Detroit. This has necessitated three shifts of employees. The west side branch will be completed and occupied by June 1.

Simplex Plant in Los Angeles—One of the most completely equipped and up-to-date body-building plants in the country is now located in Los Angeles, Cal. This plant is now being operated by the Pacific Coast agents of the Simplex car and in the future a number of Simplexes, instead of being shipped with body complete, will be shipped in chassis form and the bodies built and mounted in Los Angeles. The plant comprises a large three story building and every sort of modern machinery used in the construction of high grade automobile bodies of both wood and metal has been installed. Extensive paint shops are also an improved branch of the plant and after the expert coach builders have completed their work, the body is removed to the paint shop floor where they are painted with high grade enamels.

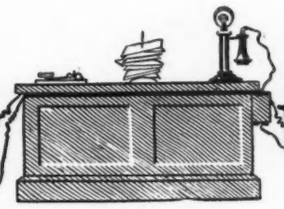
Claim Steel Products Won't Rust—Under the direction of the Commercial Club of Green Bay, Wis., a corporation is being organized to establish a factory for the production of motor car parts, such as hub-caps, door knobs and plates, lamps, handles, etc., as well as surgical implements, fittings and other similar articles, out of a new metal alloy formulated by J. A. Fletcher of Chicago, well known in the copper and brass foundry field. Mr. Fletcher several years ago perfected a metal which appears to be as strong as steel but needs no plating or polishing. It is a solid silver white metal and will not tarnish or rust. John F. Martin, president of the Commercial club, is making a canvass of Green Bay capitalists and intends to form a $100,000 corporation to establish a plant employing from 150 to 250 workmen.

Gas Electric Engines to be Manufactured—As a result of recent investigations regarding the possibilities of Vancouver, B. C., as a manufacturing centre, J. S. MacDonald, of the Phoenix Co., Eau Claire, Wis., is planning to establish an extensive iron and steel factory with a plant for turning out gas electric engines, passenger cars, tractors, motor trucks, and such other apparatus as can be operated by gas electric engines. Mr. MacDonald is convinced that machinery may be manufactured in Vancouver as cheaply as it is turned out in Pittsburgh or in any of the Ontario centres, this reasoning being based chiefly on the fact that Vancouver has the raw material almost at her door.

The Automobile Calendar—Shows, Meetings, Etc.

Feb. 14-21	Pittsburgh, Pa., Automobile Show, Pittsburgh Auto Show Assn.
Feb. 16-21	Toronto, Ont., Show, Toronto Auto Trade Assn.
Feb. 16-21	Memphis, Tenn., Show, Memphis Business Men's Club and Auto Dealers' Assn.
Feb. 16-22	Kansas City, Mo., Auto Show.
Feb. 16-21	Toronto, Ont., Automobile Show, E. M. Wilcox.
Feb. 17-21	Salt Lake City, Utah, Automobile Show, W. D. Rishel.
Feb. 18-21	Easton, Pa., Automobile Show.
Feb. 18-21	Bloomington, Ill., Automobile Show, McLean County Automobile Club.
Feb. 18-21	Albany, N. Y., Passenger Car Annual Show, State Armory, Albany Auto Dealers' Assn.
Feb. 21	Santa Monica, Cal., Vanderbilt Cup Race.
Feb. 21-28	Newark, N. J., Automobile Show, N. J. Auto Trade Assn.
Feb. 21-28	Cincinnati, O., Automobile Show, Cincinnati Automobile Dealers' Assn.
Feb. 23	Santa Monica, Cal., American Grand Prix.
Feb. 23-25	Albany, N. Y., Commercial Show.
Feb. 23-28	Danville, Ill., Vermillion Co. Auto Show.
Feb. 23-28	Indianapolis, Ind., Auto Show, Indianapolis Auto Trade Assn.
Feb. 23-28	Omaha, Neb., Automobile Show, Omaha Automobile Assn.
Feb. 24-28	Syracuse, N. Y., Automobile Show, State Armory, Syracuse Automobile Dealers' Assn.
March 2-4	Cincinnati, O., Commercial Vehicle Show, Cincinnati Automobile Dealers' Assn.
March 2-7	Sioux City, Ia., Show, New Auditorium Bldg., Sioux City Auto Club Assn.
March 2-7	Utica, N. Y., Show, Automobile Club, W. G. Comstock, Manager.
March 3-7	Fort Dodge, Ia., Show, Fort Dodge Auto Dealers' Assn.
March 3-7	Tiffin, O., Show, *Tiffin Advertiser.*
March 7-14	Hamilton, Ont., Passenger and Truck Show.
March 7-14	Boston, Mass., Automobile Show.
March 9-14	Des Moines, Ia., Show, Des Moines Automobile Dealers' Assn.
March 17-21	Boston, Mass., Truck Show.
March 18-22	Sharon, Pa., Auto Show.
March 21-28	St. John, B. C., Show, Armory, New Brunswick Auto Assn.
April 9-15	Manchester, N. H., Automobile Show.
April 12-19	Prague, Austria, Eleventh Annual International Auto Exhibition, Royal Tiergarten.
May 30	Indianapolis, Ind. 500-mile Race, Indianapolis Motor Speedway.
June 24-26	Chicago, Ill., Seventh Annual Meeting of Nat. Gas Engine Assn.
July 3-4	Tacoma, Wash., Road Races. Tacoma Carnival Assn.
July 4	Sioux City, Iowa, 300-mile Race, Sioux City Auto Club and Speedway Assn.
July 4	Lyons, France, French Grand Prix.
July 13-14	Seattle, Wash., Track Races, Seattle Speedway Assn.
July 25-26	Belgium Grand Prix Road Races.
Aug. 28-29	Chicago, Ill., Elgin Road Races, Chicago Automobile Club.
Sept. 9	Corona, Cal., Road Race, Corona Auto Assn.
Oct. 1	Paris, France, Kerosene Motor Competition.
Oct. 19-26	Atlanta, Ga., American Road Congress of the American Highway Assn. and the A. A. A.
November	El Paso, Tex., Phoenix Road Race, El Paso Auto Club.

The Week in the Industry



Motor Men in New Roles

BRUCE Daniels Stutz Advertising Manager—Bruce Daniels has been appointed by the Stutz M. C. Co., Indianapolis, Ind., as advertising manager. He will also become assistant to W. D. Myers, sales manager. Mr. Daniels served in a like capacity with the Pathfinder company, Indianapolis, for 2 years.

Hunziker Heads Luverne Co.—J. W. Hunziker has taken charge of the Luverne Automobile Sales Co., Minneapolis, Minn.

McGregor Dies—C. G. McGregor, manager of the Brooklyn, N. Y., branch of the C. T. Silver Co., died on Sunday last of pneumonia.

Bartlett Universal Sales Manager—H. W. "Pop" Bartlett has been made sales manager at the factory for the Universal Motor Co., Washington, Pa.

Urquhart Resigns—J. B. Urquhart, formerly vice-president and general manager of all the branches west of Fort William for John Millen Son & Urquhart, Vancouver, B. C., has resigned.

Lamb Ideal Truck Sales Manager—F. E. Lamb, formerly sales manager of the Gramm M. C. Co., Bowling Green, O., has joined the selling staff of the Ideal Auto Co., Ft. Wayne, Ind. He will act as sales manager.

Drought Heads Wisconsin Dealers Assn.—J. T. Drought was elected president of the Wisconsin State Automobile Dealers' Assn. G. A. West of Milwaukee, was elected treasurer and H. A. Apple, secretary.

Allen Heads B. C. Trade Assn.—The annual meeting of the B. C. Auto and Motor Trade Assn., Vancouver, B. C., was held recently and H. G. Allen was elected president. C. A. Ross was elected treasurer.

First A. C. A. President Dies—G. F. Chamberlain of New York City, died suddenly February 9, at the age of 53. He was one of the founders of the Automobile Club of America, of which he was the first president.

Humpage Treasurer International Chemical—F. R. Humpage, formerly general manager of the Thomas M. C. Co., Buffalo, N. Y., has been elected treasurer for the International Chemical Co., Bridgeburg, Ont.

Beharrell Takes Tire Job—Arthur Beharrell, formerly connected with the sales department of the New England branch of the Studebaker Corp., Boston, Mass., resigned recently to become manager of the Fisk Tire Co.'s branch at Lowell, Mass.

Beck Pennsylvania Tire Representative—F. B. Beck has become Connecticut sales representative of the Pennsylvania Rubber Co., Jeannette, Pa., manufacturer of vacuum cup tires. He was formerly representative of the U. S. Tire Co., in the same territory.

Automobile Insurance Co. Elects Officers—At the first annual meeting of the stockholders of the Automobile Insurance Co., Hartford, Conn., M. G. Bulkeley was reelected president; M. G. Brainard, vice-president; J. S. Rowe, secretary and C. H. Remington, treasurer.

Wade to Sell Schafer Bearings—C. E. Wade, of Detroit, Mich., has been appointed sole selling agent in the Middle West for Schafer ball bearings, imported by Barthel & Miller, New York City. He was formerly selling representative for the Rhineland Machine Works Co.

Willetts Withdraws from Remy Electric—E. F. Willetts has withdrawn from his position as manager of the Detroit branch of the Remy Electric Co., and will establish himself as general manufacturers' representative. He is succeeded as Remy manager by J. M. Bell.

Ligon Appointed District Manager—D. J. Ligon of Atlanta, Ga., has been appointed district manager for the Detroit-Wyandotte Motor Co., Wyandotte, Mich. He was previously associated with the Maxwell company, U. S. Motors, Grabowsky company and the Chalmers company.

App with La Vigne—James App, formerly assistant general manager of the Cartercar Company and lately purchasing agent for the Chevrolet Motor Co., has joined the forces of the La Vigne Cyclecar Co., Detroit, Mich. He will act as purchasing agent for the cyclecar company.

Busby Duplex Governor Engineer—L. B. Busby, chief engineer of the gasoline motor department of the Electric Launch Co., has resigned to become engineer for the Duplex Engine Governor Co., New York City. He is now on a western trip making trip making test installations of the governor at various manufacturing plants.

Vaughan Heads Toledo U. S. Tire Branch—C. Q. Vaughn, for several years district representative of the United States Tire Co., Toledo, O., has been promoted to the position of manager of the Toledo branch of the company. Judd Cox, formerly the resident manager, takes the position of city sales manager and G. H. Wood that of office manager of the branch.

Firestone Representatives Shifted—The Firestone Tire & Rubber Co., Akron, O., has appointed J. F. Cast, formerly manager of the Cleveland branch of the company, as special commercial tire representative in Ohio and Indiana; F. B. Talbot, formerly manager of the Dallas branch, succeeds Cast at Cleveland; H. W. McFadden takes Talbot's place at Dallas, while G. C. Faling, who formerly traveled in the Texas territory for the Firestone company, takes McFadden's place at the head of the Houston branch.

Three New Stewart District Managers—E. McK. Hunt has been appointed district sales manager by the Stewart Motor Corp., Buffalo, N. Y., for Connecticut, New York City, New Jersey, Eastern Pennsylvania and Virginia. During the past year he has been actively engaged in selling Stewart trucks in Northern New Jersey, as a member of the Ingle Hunt Motors Co., Newark. H. R. Fletcher has been appointed district sales manager for northern and western Pennsylvania, New York State, and the provinces of Quebec and Ontario, in Canada. He has been connected with the E. V. Stratton Co., Albany, N. Y., for the past year, in charge of the Stewart truck division. J. J. Martin has been appointed district sales manager for Stewart motor trucks in the Middle West, with headquarters in Chicago, Ill. For the past 18 months he has been connected with the Commerce M. C. Co., Detroit, Mich.

Garage and Dealers' Field

Kansas City Co. Removes—The Motor Tire and Repair Co. has removed from 1826 to 1817 Grand avenue, Kansas City, Mo., where larger quarters were obtained.

John & Arthur Moves—The John & Arthur Co., one of the biggest accessory houses in Boston, Mass., has moved from Boylston street to Massachusetts avenue, taking the place vacated by the Cole Motor Car Co.

Crescent Wants Additional Equipment—The Crescent Motor Co., Carthage, O., which recently secured the plant of the defunct Ohio Motor Car Co., will be in the market for additional equipment soon. Plans are in preparation for additions to the manufacturing facilities.

Co. Now in New Hands—The Koochook Rubber Co. at Compton and Locust streets, St. Louis, Mo., has bought the stock of the Holzmann Automobile Supply Co. and will carry on the latter's business. George Holzmann announces he will open an accessory house in Los Angeles, Cal.

St. Louis Cos. Move—Two additions were made to the St. Louis, Mo., automobile row on Locust street when the General Motor Car Co., Hupmobile distributors, and the St. Louis Stearns Auto Co. moved into the 3000 block. Each of the new buildings is built on the latest lines and has every modern convenience.

St. Louis Gasoline Cheaper—Three days after the Standard Oil Co. of Indiana announced the price of gasoline at four stations it maintains in St. Louis, Mo., nearly every automobile filling station in town made a like cut. This is the first cut in the price of gasoline for automobile use, although the general oil rates had been reduced a month ago.

New Indianapolis Taxi Rate—Horace F. Wood, of Indianapolis, Ind., has established a special shopping and calling rate for the limousine taxicabs he has in operation. The rate for this service from 1 p. m. to 5 p. m. is $2 an hour. During the other hours of the day and night a uniform rate of $2.50 an hour is charged.

Brilliant Lights Prohibited—The common council of Hartford, Conn., has

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New Agencies for Passenger Vehicles

PASSENGER VEHICLES

Place	Car	Agent
Albuquerque, N. M.	Oakland	Interstate Motor Co.
Alma, Kan.	Empire	G. A. Mueller.
Alma, Kan.	Pathfinder	G. A. Mueller.
Amarillo, Tex.	Oakland	E. A. Caldwell.
Argenta, Ark.	Oakland	Oakland Auto Co.
Atchison, Kan.	Empire	H. H. Derreough.
Atchison, Kan.	Oakland	Geo. E. King.
Atchison, Kan.	Pathfinder	H. H. Derreough.
Atlanta, Ga.	Franklin	Hull & Dube.
Auburn, N. Y.	Kisselkar	Arthur Brown.
Bartlesville, Okla.	Oakland	J. C. Brady.
Bay City, Mich.	Kisselkar	The G & G Sales Co.
Blue Mound, Kan.	Oakland	Burt & Son.
Blythesville, Mo.	Empire	White & Smith.
Blythesville, Mo.	Pathfinder	White & Smith.
Bode, Ia.	Maxwell	Kinseth & Ries.
Bombay, N. Y.	Maxwell	C. H. Barlow.
Bonduel, Wis.	Buick	Adolph Ulmer.
Brookfield, Mo.	Oakland	B. K. Newcomb.
Bucyrus, O.	Ford	A. L. Holloway.
Bucyrus, O.	Studebaker	H. A. Paxter
Burlington, Kan.	Oakland	Vesta Herrold.
California, Mo.	Maxwell	California Machine Works.
Cameron, Mo.	Oakland	R. H. Holloway.
Caney, Kan.	Oakland	Auto Sales Co.
Ceandale, Kan.	Oakland	Anderson Bros.
Chambers, Neb.	Oakland	F. A. Barnard.
Chicago, Ill.	Kisselkar	McDuffee Auto Co.
Clay Center, Kan.	Oakland	J. R. Watts.
Clifton, Kan.	Oakland	Nelson Bros.
Clutier, Ia.	Herff-Brooks	H. C. Hartwig.
Coloma, Wis.	Buick	Vilas Follett.
Columbus, O.	Allen	Snyder Auto Co.
Columbus, Kan.	Empire	D. F. Heter.
Columbus, O.	Jeffery	The Central Auto Veh. Co.
Columbus, O.	Ohio-Royal	Craighead Motor Sales Co.
Columbus, Kan.	Pathfinder	D. F. Heter.
Council Grove, Kan.	Oakland	T. J. Crippen.
Crandon, Wis.	Buick	Fred J. Rogers.
Delaware, O.	Maxwell	C. A. White.
Denver, Col.	Maxwell	Warriner & Cochran.
East Troy, Wis.	Buick	Dickerman Hardware Co.
Elmore, L. I., N. Y.	Kisselkar	Hoeffner's Garage.
Everest, Kan.	White	J. A. Lerson.
Ft. Wayne, Ind.	Herff-Brooks	H. G. Raymond.
Fort Atkinson, Wis.	Buick	William Wille Co.
Forsyth, Mont.	Franklin	Lindburg & Sickler.
Grand Rapids, Mich.	Kisselkar	Frank P. Oswald.
Green Bay, Wis.	Saxon	Louis B. Larson.
Guide Rock, Neb.	Oakland	C. A. Crow.
Guthrie Center, Iowa.	Kisselkar	Lower Bros. Auto Co.
Hermann, Mo.	Maxwell	Christ. Eberlin & Son.
Hood River, Ore.	Maxwell	Howe & Ingalls.
Independence, Mo.	Empire	C. W. Lattimer.
Iron River, Mich.	Maxwell	Lindwall & Lindstrom.
Jefferson City, Mo.	Maxwell	Tanner Bros.
Kansas City, Mo.	Dorris	Dey-Embry Motor Car Co.
Kenosha, Wis.	Buick	Thompson Motor Car Co.
Keokuk, Iowa.	Kisselkar	Central Auto & Machine Co.
Kewaunee, Wis.	Buick	Dishmaker Bros.
Kimballton, Ia.	Oakland	W. N. Esbeck.
Lake Andes, S. D.	Maxwell	J. H. Bundy.
Lake Mills, Wis.	Buick	Lake Mills Auto Co.
Lamartine, Wis.	Herff-Brooks	S. E. McCumber & Sons.
Laredo, Tex.	Maxwell	E. Denike.
Marthasville, Mo.	Maxwell	Bocklage & Mebruer.
Means, O.	Maxwell	D. A. Walton.
Mentor, O.	Maxwell	M. V. Hanson.
Merced, Cal.	Maxwell	J. J. Youd.
Minneapolis, Minn.	Briscoe	E. B. Stimson.
Minneapolis, Minn.	Lambert	C & S Motor Car Co.
Minneapolis, Minn.	McFarlan	John P. Snyder.
Moline, Ill.	Franklin	Dalton H. Duncan.
Montpelier, Vt.	Hudson	Albert J. Gauvreau.
Mystic, Conn.	Kisselkar	L. S. Doyle.
New Lexington, O.	Buick	C. C. Dillow & Sons.
New Orleans, La.	McFarlan	The Case Sales Co.
New York City.	Benz	Benz Auto Sales Co.
New London, Wis.	Buick	A. G. Jennings.
Oakesdale, Wash.	Maxwell	Oakesdale Land Co.
Oconomowoc, Wis.	Buick	Chas. Schoen & Sons.
Oregon, Ill.	Herff-Brooks	C. F. Jones.
Papillion, Neb.	Oakland	Chas. Snazel.
Patchogue, L. I., N. Y.	Kisselkar	Bellman Auto Co.
Peoria, Ill.	Herff-Brooks	Grisswold & Edmondson.
Plymouth, Wis.	Maxwell	Deichert & Arndt.
Portland, Ind.	Maxwell	Auto Supply Co.
Prattsburg, N. Y.	Maxwell	Fred D. Clark.
Quanah, Tex.	Maxwell	Citizen's Garage.
Quebec, Que.	Peugeot	Dorval & Pasnsot.
Racine, Wis.	Buick	J. C. Johnson.
Rushville, Ill.	Maxwell	Mathews Bros.
Rutland, Vt.	Maxwell	R. V. Allen.
San Francisco, Cal.	Herff-Brooks	Linz-Sanborn Motor Co.
Sexton, Ia.	Maxwell	Edward Johnson & Co.
Shawano, Wis.	Buick	Shawano Auto Co.
Sheboygan, Wis.	Kisselkar	Sheboygan Auto & Supply Co.
Shreveport, La.	Kisselkar	J. Lowe.
Sioux City, Ia.	Herff-Brooks	Adams Auto Co.
South Bend, Ind.	Herff-Brooks	J. W. Nikart.
South Lyon, Mich.	Maxwell	Challis & Smith.
Springfield, O.	Maxwell	P. T. Rathbun.
Sussex, Wis.	Buick	Fred Stier.
Sylvania, O.	Maxwell	Sylvania Auto Co.
The Dalles, Ore.	Maxwell	T. L. Dunsmore.
Tipton, Ind.	Maxwell	Kendall & Son.
Uvalde, Tex.	Maxwell	E. B. Zachry Co.
Viroqua, Wis.	Buick	Tuhus & Clark.
Wakefield, Neb.	Maxwell	Olaf Wendell.
Walworth, Wis.	Buick	Chas. McCabe.
Washington, D. C.	Davis	Presbey-Haynes Motor Co.
Waterloo, Ia.	Moon	Burd Auto Co.
Watertown, Wis.	Buick	Copeland Roach Motor Co.
Waupun, Wis.	Buick	Lansaal Bros.
Webster, N. Y.	Maxwell	L. J. Bonenblust.
Webster City, Ia.	Maxwell	Wilke Auto Co.
Westfield, Wis.	Buick	Schauer Bros.
Windsor, Ont.	Oakland	J. K. Robinson.

COMMERCIAL VEHICLES

Dayton, O.	Koehler	R. W. Kuhns.
New York City.	Gaggenau	Gaggenau Auto Sales Co.
Port Arthur, Tex.	Koehler	Crowell & Gifford.
Reading, Pa.	Koehler	American Garage.
Ripley, O.	Koehler	Cochran & Co.
Springfield, Mass.	General Vehicle	General Vehicle Co.
St. Louis, Mo.	Buffalo	Electric Garage Co.
St. Louis, Mo.	Mogul	Mogul Sales Agency.
St. Louis, Mo.	Vulcan	Mogul Sales Agency.

ELECTRIC VEHICLES

St. Louis, Mo.	Buffalo	Trenton Motor Co.
St. Louis, Mo.	Detroit	Electric Garage Co.

CYCLECARS

Boston, Mass.	Carnation	W. S. Doane.
Boston, Mass.	Twombly	H. Ross Maddocks.
Milwaukee, Wis.	Dudley-Tideman	The Wisconsin Cyclecar Co.
Milwaukee, Wis.	La Vigne	The Wisconsin Cyclecar Co.
Milwaukee, Wis.	Trumbull	The Wisconsin Cyclecar Co.
Milwaukee, Wis.	Zip	The Wisconsin Cyclecar Co.
New Orleans, La.	Imp.	C. B. McConklin.
New York City.	Imp.	E. J. Willis.
Omaha, Neb.	Imp.	Nebraska Cyclecar Co.
Philadelphia, Pa.	Imp.	Penn Cyclecar Co.
Phœnix, Ariz.	Imp	Phœnix Auto Co.
Phœnix, Ariz.	Imp.	Phœnix Garage Co.
Pittsburgh, Pa.	Imp.	C. N. Leet.
Portland, Ore.	Imp.	Berger Cycle & Supply Co.
Providence, R. I.	Imp.	C. G. Batchell.
San Antonio, Tex.	Imp.	Texas Motor Truck Co.
San Francisco, Cal.	Imp.	C. L. Barnett.
San Francisco, Cal.	Imp.	Western Cycle Car Co.
San Jose, Costa Rica.	Imp.	J. N. Bliss.
San Juan, Porto Rica.	Imp.	Sandiago A. Panzardi.
Seattle, Wash.	Imp	McIntyre Sales Co.
Sioux City, Ia.	Imp.	Thos. Murphy.
Spokane, Wash.	Imp.	Imp Cyclecar & Supply Co.
St. Louis, Mo.	Imp	Oldsmobile Co. of Mo.
St. Louis, Mo.	LaVigne	Oldsmobile Co. of Mo.
Toronto, Can.	Imp.	Hatfield Auto Tr. Sales Co.
Trenton, N. J.	Imp.	G. B. Yard.
Washington, D. C.	Imp	H. B. Leary, Jr.

Garage and Dealers' Field (Continued)

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adopted a form of ordinance against automobile and trolley car headlights which provides for a fine of $5 for violations. Under the provisions of this ordinance brilliant lights cannot be used within the city limits. Fire department apparatus is exempt while on the way to or at a fire.

Takes New Departure Agency—The Hearsey-Willis Co., Indianapolis, Ind., has secured the agency for New Departure ball bearings in Indianapolis and vicinity. The company expects to carry a large stock, in order to assure immediate replacements.

Corbin Speedometer Moves in N. Y. City—The Corbin Brown Speedometer has removed its New York office from 1860 Broadway, where it has been located for the past 3 years, to the corner of Broadway and 63 street. In its new quarters the company has opened up a complete service, supply and repair station.

Large St. Louis Electric Service Station—The merger of the Detroit Electric Car Co. with the Electric Garage and Service Co. creates the largest service station in St. Louis, Mo. The company will maintain a great electric vehicle garage on Delmar avenue, which will have storage facilities for some one hundred cars and have a large paint, machine shop and battery department in addition.

New Ford Service Station—The new Ford retail and service station near the capitol, in St. Paul, Minn., is to be opened March 1. The building is three stories and basement, 100 by 150 feet, and cost about $45,000. The tile roof is made so machines can be worked out on top of the building. The output in St. Paul is estimated at 500 cars. The new branch in Minneapolis, ten stories, will be ready in the fall. The company put out 6,000 cars in 1913 and will ship 10,000 in 1914 from this house.